MINERALS YEARBOOK

1954

Volume III of Three Volumes

AREA REPORTS

Prepared by the field staff of the
BUREAU OF MINES
REGIONAL DIVISIONS OF MINERAL INDUSTRIES

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FOREWORD

Minerals Yearbook 1954, published in three volumes, includes data collected for the 1954 Census of Minerals Industry. All data collected in cooperation with the Bureau of the Census are noted in either text or footnotes in the commodity chapters. Unless otherwise stated, the data were collected by the Bureau of Mines. When final Census data become available, differences in totals will be reconciled.

Volume I includes chapters on mineral commodities, both metals and nonmetals, but exclusive of the mineral fuels. Included also are a chapter reviewing these mineral industries, a statistical summary, and chapters on mining technology, metallurgical technology, and employment and injuries.

Volume II includes chapters on each mineral-fuel commodity, as well as chapters reviewing the industry as a whole, a statistical summary, and an employment and injury presentation.

Volume III is comprised of chapters covering each of the 48 States, plus chapters on the Territory of Alaska, the Territory of Hawaii and island possessions in the Pacific Ocean, and the Commonwealth of Puerto Rico and island possessions in the Caribbean Sea, including the Canal Zone. Volume III also has a statistical summary chapter and another presenting employment and injury data. The indexing of Volume III has been suspended with the 1954 issue as the parallel structure of the area chapters appered to afford sufficient guidance to information. The initial page of each State chapter is given in the Table of Contents. Each chapter has in sequence an introductory section, commodity review section, and county review section.

The data presented in the Minerals Yearbook are based largely upon information obtained from mineral producers, processors, and users, and acknowledgment is made of this indispensable cooperation given by industry. Information obtained from individuals by means of confidential surveys have been grouped to provide statistical aggregates. Data on individual producers are presented only if available from published or other nonconfidential sources, or when permission of the individuals concerned has been granted.

MARLING J. ANKENY, *Director.*

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ACKNOWLEDGMENTS

In preparing this volume of the MINERALS YEARBOOK, the Bureau of Mines was assisted in collecting statistical data and mineral-industry information by State and Territorial agencies, through cooperative agreements. Many State chapters were reviewed by staff members of these agencies, and in some instances the staff members collaborated in preparing the chapters and are shown as co-authors. For this assistance, acknowledgment is made to the following cooperating State and Territorial organizations:

Alabama: Geological Survey of Alabama.
Alaska: Alaska Territorial Department of Mines.
Arkansas: Division of Geology.
California: Division of Mines.
Delaware: Delaware Geological Survey.
Florida: Florida Geological Survey.
Georgia: Department of Mines, Mining, and Geology.
Illinois: Illinois State Geological Survey.
Indiana: Indiana Department of Conservation.
Iowa: Iowa Geological Survey.
Kansas: State Geological Survey of Kansas.
Kentucky: Kentucky Geological Survey.
Louisiana: Louisiana Geological Survey.
Maine: Department of Development of Industry and Commerce.
Maryland: Department of Geology, Mines, and Water Resources.
Michigan: Michigan Department of Conservation.
Mississippi: Mississippi Geological Survey.
Missouri: Division of Geological Survey and Water Resources.
Montana: Montana Bureau of Mines and Geology.
Nevada: Conservation and Survey Division.
New Hampshire: New Hampshire State Planning and Development Commission.
New Jersey: Bureau of Geology and Topography.
New York: State Geological and Natural History Surveys.
North Carolina: Division of Mineral Resources.
North Dakota: North Dakota Geological Survey.
Oklahoma: Oklahoma Geological Survey.
Oregon: State Department of Geology and Mineral Industries.
Pennsylvania: Bureau of Topographic and Geological Survey.
South Carolina: Department of Geology, Mineralogy and Geography.
South Dakota: State Geological Survey.
Tennessee: Tennessee Department of Conservation.
Texas: Bureau of Economic Geology.
Utah: Utah Geological and Mineralogical Survey.
Virginia: Virginia Geological Survey.
Washington: Department of Conservation and Development.
West Virginia: West Virginia Geological and Economic Survey.
Wisconsin: Wisconsin Geological and Natural History Survey.
Wyoming: Geological Survey of Wyoming.

Except for the two review chapters, this volume was prepared by the field staffs of the five Divisions of Mineral Industries. The following supervised preparation of the chapters: Albert J. Kauffman, Jr., chief, Division of Mineral Industries, Region I, Albany, Oreg.; Alvin Kaufman, chief, Field Office, Region I, Juneau, Alaska; R. B. Maurer,

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chief, Division of Mineral Industries, Region II, San Francisco, Calif.; Alfred L. Ransome, chief, Division of Mineral Industries, Region III, Denver, Colo.; Robert S. Sanford, chief, Division of Mineral Industries, Region IV, Bartlesville, Okla.; Robert D. Thomson, acting chief, Division of Mineral Industries, Region V, Pittsburgh, Pa.; S. A. Gustavson, chief, Field Office, Region V, Minneapolis, Minn.; Avery H. Reed, Jr., chief, Field Office, Region V, Knoxville, Tenn. Preparation of this volume was supervised and the chapters coordinated with those in volumes I and II by Paul Yopes, assistant to the chief, Division of Minerals.

Statisticians and researchers in the Division of Mineral Industries who gave substantial assistance to the authors of the chapters were: In Region I, Opal Y. Sharman and Catherine M. Vroman; in Region II, Roy Y. Ashizawa; in Region III, Stella K. Drake and Virginia C. Halverson; in Region IV, Eunice M. Clark and Dorothy O. Stearns; in Region V, Naomi R. Harrison, Jo D. Stallings, Mildred Rivers, and Roy H. Davis.

The manuscripts upon which this volume is based have been reviewed to insure statistical consistency between the tables, figures, and text, between this volume and volumes I, and II, and between this volume and those for former years by a staff under the direct supervision of Kathleen J. D'Amico, assisted by Julia Muscal, Hope R. Anderson, Helen L. Gealy, Ruby J. Phillips, Anita C. Going, Helen E. Tice, and Anne Rogers.

Minerals Yearbook compilations are based largely on data provided by the mineral industries. Acknowledgment is made of the willing contribution both by companies and individuals of these essential data.

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Statistical Summary of Mineral Production

By Kathleen J. D'Amico [1]

A COMPLETE summary is given in this volume and in volume III of this series of mineral production in the United States, its Territories and possessions, and the Commonwealth of Puerto Rico and of principal minerals imported into and exported from the United States. A summary table comparing world and United States mineral production also is included.

Mineral production may be measured at any of several stages of extraction and processing. The stage of measurement used in the chapter is normally what is termed "mine output." It usually refers to minerals in the form in which they are first extracted from the

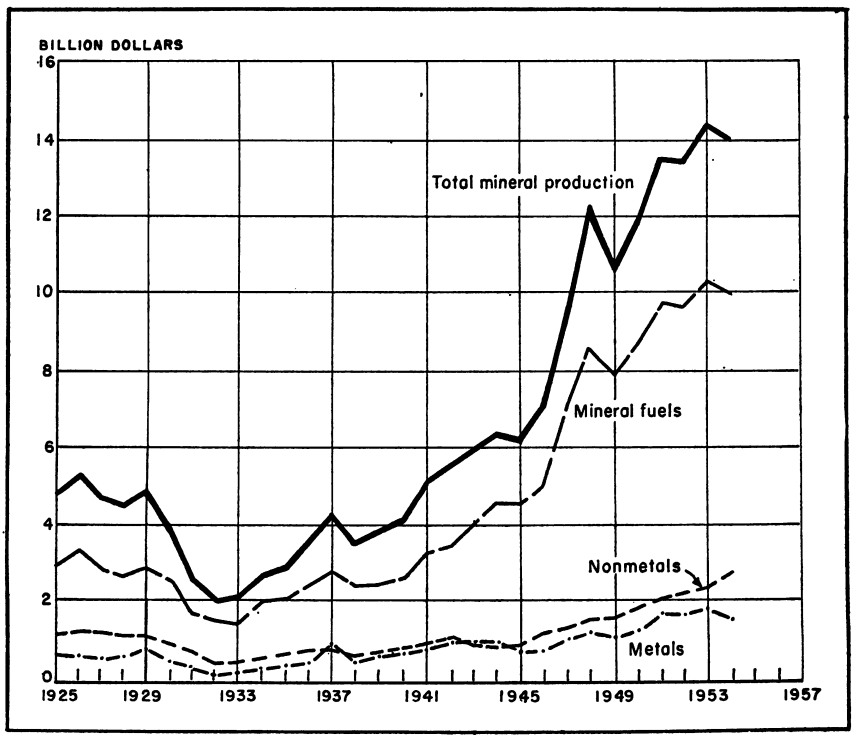

FIGURE 1.—Value of mineral production in continental United States, 1925–54.

[1] Publications editor.

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ground but customarily includes, for some minerals, the product of auxiliary processing operations at or near mines.

Because of inadequacies in the statistics available, some series deviate from the foregoing definition. The quantities of gold, silver, copper, lead, zinc, and tin are recorded on a mine basis—that is, as the recoverable content of ore sold or treated; the values assigned to these quantities, however, are based on the average selling price of refined metal, not the mine value. Mercury is measured in the form of recovered metal and valued at the average New York price for metal.

Data for clays and limestone in 1954 include output used in making cement and lime. Mineral-production totals have been adjusted to eliminate duplication of these values.

The weight or volume units shown are those customary in the particular industries producing the respective commodities. No adjustment has been made in the dollar values for changes in the purchasing power of the dollar.

TABLE 1.—Value of mineral production in continental United States, 1925–54, by mineral groups [1]

(Million dollars)

Year	Mineral fuels	Non-metallic minerals (except fuels)	Metals	Total	Year	Mineral fuels	Non-metallic minerals (except fuels)	Metals	Total
1925	2,910	1,187	715	4,812	1940	2,662	784	752	4,198
1926	3,371	1,219	721	5,311	1941	3,228	989	890	5,107
1927	2,875	1,201	622	4,698	1942	3,568	1,056	999	5,623
1928	2,666	1,163	655	4,484	1943	4,028	916	987	5,931
1929	2,940	1,166	802	4,908	1944	4,574	836	900	6,310
1930	2,500	973	507	3,980	1945	4,569	888	774	6,231
1931	1,620	671	287	2,578	1946	5,090	1,243	729	7,062
1932	1,460	412	128	2,000	1947	7,188	1,338	1,084	9,610
1933	1,413	432	205	2,050	1948	9,502	1,552	1,219	12,273
1934	1,947	520	277	2,744	1949	7,920	1,559	1,101	10,580
1935	2,013	564	365	2,942	1950	8,689	1,822	1,351	11,862
1936	2,405	685	516	3,606	1951	9,779	2,079	1,671	13,529
1937	2,798	711	756	4,265	1952	9,615	2,163	1,614	13,392
1938	2,436	622	460	3,518	1953	10,249	[2] 2,342	[2] 1,797	[2] 14,388
1939	2,423	754	631	3,808	1954	9,909	[2] 2,617	1,506	14,032

[1] Data for 1925–46 are not strictly comparable with those for subsequent years, since for the earlier years the value of heavy clay products has not been replaced by the value of raw clays used in such products.
[2] Revised figure.
[3] The total has been adjusted to eliminate duplication in the value of clays and stone.

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TABLE 2.—Mineral production in continental United States, 1951–54 [1]

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
MINERAL FUELS								
Asphalt and related bitumens (native):								
Bituminous limestone and sandstone	1,378,434	$4,159,259	1,570,698	$4,687,512	1,440,544	$4,349,327	1,337,822	$3,686,227
Gilsonite	65,521	1,895,374	60,740	1,779,815	60,505	2,184,328	75,943	2,724,023
Carbon dioxide, natural (estimated)—thousand cubic feet	547,436	161,000	737,000	226,250	670,600	203,450	638,900	210,700
Coal:								
Bituminous [2]	529,879,295	2,614,219,188	463,137,264	2,276,189,066	453,577,946	2,232,698,609	386,796,876	1,749,538,569
Lignite	3,291,104	8,043,962	3,017,300	7,211,912	2,851,032	6,793,648	4,242,806	10,330,000
Pennsylvania anthracite	42,669,997	405,817,963	40,582,558	379,714,076	30,949,152	299,139,687	29,083,477	247,870,023
Helium—cubic feet	108,970,000	1,387,000	145,810,332	1,896,096	157,652,134	2,102,721	189,873,071	3,202,206
Natural gas (marketed production)—million cubic feet	7,457,359	542,964,400	8,013,457	623,649,460	8,396,916	774,966,250	8,742,546	882,501,350
Natural-gas liquids:								
Natural gasoline and cycle products—thousand gallons	4,971,834	369,718,000	5,102,244	371,468,000	5,327,448	406,242,000	5,385,282	402,418,000
LP-gases—do	3,627,834	138,443,000	4,285,386	161,692,000	4,692,870	191,598,000	5,204,304	178,994,000
Peat	194,416	1,489,225	210,582	1,729,511	204,209	1,617,947	243,257	2,248,532
Petroleum (crude)—thousand 42-gallon barrels	2,247,711	5,690,410,000	2,289,836	5,785,230,000	2,357,082	6,327,100,000	[3] 2,314,988	[3] 6,424,930,000
Total mineral fuels		9,779,000,000		9,615,000,000		10,249,000,000		9,909,000,000
NONMETALLIC MINERALS (EXCEPT FUELS)								
Abrasive stone: [4]								
Grindstones and pulpstones	5,571	315,871	3,974	247,434	2,499	169,951	2,218	163,995
Millstones	(5)	6,000	(5)	9,285	(5)	18,375	(5)	(5)
Pebbles (grinding)	3,062	84,306	2,804	93,949	2,472	81,159	3,070	99,491
Tube-mill liners (natural)	1,408	77,027	1,739	67,724	1,219	68,688	933	59,471
Asbestos	51,645	3,912,500	53,864	4,713,032	54,456	4,857,359	47,621	4,697,962
Barite	860,669	7,968,023	941,825	8,797,944	944,212	9,435,749	883,283	8,508,185
Boron minerals	862,797	20,030,000	583,828	14,105,000	715,228	17,668,000	790,449	26,714,440
Bromine—pounds	129,563,073	26,179,556	156,201,577	30,639,292	164,143,348	35,372,386	187,399,110	41,312,669
Calcium-magnesium chloride (75-percent (Ca, Mg) Cl_2 basis)	328,042	4,756,242	(6)	(6)	(6)	(6)	(6)	(6)
Cement—376-pound barrels	240,331,112	611,751,089	250,821,410	637,746,171	260,696,761	698,268,154	274,703,163	763,413,017
Clays	43,415,779	128,622,316	42,287,073	131,032,163	[7] 42,297,853	[7] 125,023,924	42,365,206	123,165,420
Emery	11,634	160,212	10,352	141,911	10,562	143,974	9,758	132,313
Epsom salts from epsomite			(6)	(6)	200	8,000	(6)	(6)
Feldspar—long tons	400,439	2,815,587	420,831	3,696,018	452,600	4,594,450	411,018	3,490,466
Fluorspar	347,024	14,369,521	331,273	15,353,634	318,036	15,736,908	245,628	12,332,779
Garnet (abrasive)	14,050	1,246,947	11,390	981,841	10,520	988,797	14,183	971,353

For footnotes, see end of table.

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TABLE 2.—Mineral production in continental United States, 1951–54 [1]—Continued

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
NONMETALIC MINERALS—Continued								
Gem stones (estimated)	([5])	$450,000	([5])	$490,000	([5])	$492,000	([5])	$597,000
Graphite	6,808	771,434	5,081	594,618	6,281	([6])	([6])	([6])
Gypsum	8,665,534	24,024,101	8,415,300	22,896,051	8,292,876	23,175,073	8,995,960	27,383,515
Iron oxide pigment materials (crude)							33,998	341,694
Lime (open-market)	8,236,422	96,507,144	8,055,609	94,795,435	9,659,414	111,777,018	8,612,360	101,273,040
Lithium minerals	12,897	896,000	15,611	1,052,000	([6])	([6])	([6])	([6])
Magnesite	670,167	4,506,712	510,750	2,871,548	553,147	3,223,759	284,015	1,391,392
Magnesium compounds from sea water and brines (except for metals)—MgO equivalent	118,638	9,638,085	121,525	9,392,913	136,824	10,459,502	111,716	8,943,684
Marl:								
Calcareous (except for cement)	269,955	233,787	260,213	187,148	277,354	173,347	206,257	152,491
Greensand	5,067	263,944	4,600	177,847	6,821	193,404	2,838	198,909
Mica:								
Scrap	71,871	1,884,087	75,236	1,954,286	73,259	1,823,840	81,073	1,733,772
Sheet—pounds	594,884	160,322	697,989	908,135	1,068,706	2,153,584	662,150	2,393,041
Olivine	([6])	([6])	([6])	([6])	([6])	([6])	([6])	([6])
Perlite	153,502	858,099	164,845	1,002,920	198,751	1,439,658	219,703	1,762,100
Phosphate rock [8]—long tons	10,775,032	64,761,149	12,064,892	72,458,982	12,503,830	76,631,755	13,821,100	86,669,081
Potassium salts—K_2O equivalent	1,408,408	44,788,880	1,598,354	53,754,316	1,731,607	[7] 65,403,202	1,918,157	71,818,934
Pumice and pumicite	749,192	2,739,907	597,044	2,266,981	1,338,206	2,509,501	1,552,074	2,934,837
Pyrites—long tons	1,017,769	4,656,000	994,342	4,947,000	922,647	5,006,499	908,715	7,159,496
Quartz from pegmatites and quartzite	281,047	1,165,370	246,604	1,013,637	241,722	1,384,398	([9])	([9])
Salt (common)	20,196,565	69,615,662	19,532,276	70,870,767	20,775,073	78,129,657	20,660,379	105,470,444
Sand and gravel	393,644,618	329,870,466	424,605,508	344,568,531	[7] 432,285,569	[7] 369,214,099	553,692,386	496,671,727
Sand and sandstone (ground)	818,479	7,163,343	792,802	6,922,586	784,792	6,873,591	([10])	([10])
Slate	819,360	14,534,327	739,640	12,706,651	698,589	12,638,465	760,921	12,960,614
Sodium carbonate (natural)	350,688	8,368,037	323,479	7,828,033	419,206	10,627,460	527,282	13,536,345
Sodium sulfate (natural)	([6])	([6])	236,825	3,217,000	248,230	3,340,760	249,701	3,890,303
Stone [11]	284,146,601	433,044,352	301,736,339	460,115,552	[7] 302,248,274	[7] 473,079,603	404,550,849	602,037,290
Strontium minerals (crude)					50	1,000	12	300
Sulfur:								
Frasch-process mines—long tons	4,988,101	107,300,000	5,141,392	110,925,000	5,224,202	141,054,000	5,328,040	142,014,215
Other mines—do	3,945	75,609	4,686	91,310	152,473	769,140	185,085	([6])
Sulfur, recovered elemental—do	[7] 193,780	5,050,149	[7] 226,258	5,660,794	[7] 315,019	8,059,243	399,950	11,208,576
Talc, pyrophyllite, and soapstone	[12] 636,068	[12] 11,322,830	[12] 593,147	[12] 11,347,317	[12] 631,538	[12] 3,524,035	[12] 618,994	[12] 3,492,548
Titanium-iron concentrate (nontitanium use)	([6])	([6])	([6])	([6])	1,585	7,500	([6])	([6])
Tripoli	37,476	1,105,135	35,459	1,043,124	36,183	1,138,635	41,625	1,458,762
Vermiculite	209,008	2,679,148	208,906	2,657,826	189,535	2,445,381	195,538	2,537,577
Undistributed: Aplite, brucite, diatomite, iodine, kyanite, sharpening stones, wollastonite, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 6). Ex-								

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cludes value of clays used for cement		7,992,344		6,484,763		[7] 12,474,546		22,438,142
Total nonmetallic minerals		2,079,000,000		2,163,000,000		[7] 2,342,000,000		[15] 2,617,000,000
METALS								
Antimony ore and concentrate—gross weight	9,100	[14]	4,434	[14]	2,161	[14]	4,686	[14]
Bauxite—long tons, dried equivalent	1,848,676	12,477,516	1,667,047	10,776,254	1,579,739	13,439,141	1,994,896	16,403,388
Beryllium concentrate—gross weight	484	161,361	515	233,757	751	354,681	669	303,649
Chromite—do	7,056	510,741	21,304	1,776,981	58,817	3,432,872	160,412	6,955,653
Cobalt (content of ore)—pounds	755,631	[14]	836,372	[14]	1,775,489	[14]	2,219,396	[14]
Columbium-tantalum concentrate—pounds, gross weight	925	1,528	5,385	16,723	14,867	29,780	32,829	57,262
Copper (recoverable content of ores, etc.)	928,329	449,311,235	925,359	447,873,756	926,448	531,781,152	835,468	492,926,757
Gold (recoverable content of ores, etc.)—troy ounces	1,741,026	60,935,910	1,652,704	57,844,640	1,704,510	59,657,850	1,588,799	55,607,965
Iron ore, usable (excluding byproduct iron sinter) long tons, gross weight	115,621,556	629,837,139	97,236,397	590,346,970	117,197,537	790,491,229	76,089,865	525,416,136
Lead (recoverable content of ores, etc.)	388,143	134,297,478	390,161	125,631,842	342,635	89,770,370	325,419	89,164,759
Manganese ore (35 percent or more Mn)—gross weight	105,007	6,045,452	115,379	8,251,774	157,536	[7] 12,480,009	206,128	15,175,533
Manganiferous ore (5 to 35 percent Mn)—do	1,171,991	5,239,986	1,009,018	5,116,985	1,239,390	[7] 6,946,612	558,332	3,079,380
Manganiferous residuum—do	267,751	[14]	215,255	[14]	293,758	[14]	214,931	[14]
Mercury—76-pound flasks	7,293	1,532,478	12,519	2,492,533	14,297	2,759,750	17,497	4,626,032
Molybdenum (content of ore and concentrate)—pounds	37,954,544	36,176,900	42,717,443	40,844,575	53,823,235	52,361,505	61,104,742	64,070,350
Nickel ore—do					21,254	[14]	27,719	[14]
Silver (recoverable content of ores, etc.)—troy ounces	39,733,909	35,961,195	39,419,344	35,676,497	37,535,451	33,971,479	36,907,686	33,403,320
Tin (content of ore and concentrate)—long tons	19	55,757	17	45,324	[14]	[14]	[14]	[14]
Titanium concentrate:								
Ilmenite—gross weight	510,840	7,689,272	522,515	8,022,752	512,176	7,222,641	531,895	7,375,274
Rutile—do	[14]	[14]	[14]	[14]	6,476	702,791	7,305	869,677
Tungsten concentrate—60-percent WO_3 basis	6,265	22,936,638	7,603	28,943,162	9,587	35,932,751	13,691	51,433,357
Vanadium—pounds	6,175,371	[14]	7,200,013	[14]	9,285,898	[14]	9,860,028	[14]
Zinc (recoverable content of ores, etc.)	681,188	249,330,389	666,001	222,981,864	547,430	125,320,890	473,471	102,179,867
Zirconium concentrate	[14]	[14]	[14]	[14]	21,234	793,685	17,959	820,041
Undistributed: Magnesium chloride for magnesium metal, platinum-group metals (crude), rare-earth metal concentrate, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 14)		18,571,347		26,782,134		[7] 29,825,786		36,083,831
Total metals		1,671,000,000		1,614,000,000		[7] 1,797,000,000		1,506,000,000
Grand total mineral production		13,529,000,000		13,392,000,000		[7] 14,388,000,000		14,032,000,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers). Excludes uranium ores and monazite.
[2] Includes small quantity of anthracite mined in States other than Pennsylvania.
[3] Final figure. Supersedes preliminary figure given in commodity chapter.
[4] Excludes sharpening stones, value for which is included with "Nonmetallic minerals, undistributed."
[5] Weight not recorded.
[6] Value included with "Nonmetallic minerals, undistributed."
[7] Revised figure.
[8] Basis for reporting phosphate rock has been changed from shipments to marketable production, because the latter more nearly reflects output at the mine on a calendar year basis.
[9] Beginning with 1954, quartz from pegmatites and quartzite included with stone.
[10] Beginning with 1954, sand and sandstone (ground) included with sand and gravel or stone.
[11] Excludes abrasive stone, bituminous limestone, bituminous sandstone, and ground soapstone, all included elsewhere in table. Also excludes limestone for cement and lime.
[12] Sold or used by producers. Quantity and value ground material.
[13] Mine production of crude material.
[14] Value included with "Metals, undistributed."
[15] The total has been adjusted to eliminate duplication in the value of clays and stone.

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TABLE 3.—Minerals produced in continental United States and principal producing States in 1954

Rank in value	Mineral	Principal producing States	
		In order of quantity	In order of value
	Abrasive stone:		
74	Grindstones and pulpstones	Ohio	Rank same as for quantity.
86	Millstones	Not available	North Carolina, New York.
78	Pebbles (grinding)	Minnesota, Wisconsin, North Carolina, Texas	Rank same as for quantity.
83	Sharpening stones	Arkansas, New Hampshire, Indiana	Do.
79	Tube-mill liners (natural)	Minnesota, Wisconsin, North Carolina	Do.
70	Antimony ore and concentrate	Idaho, Nevada	Do.
67	Aplite	Virginia	Do.
41	Asbestos	Vermont, Arizona, North Carolina, California	Do.
39	Asphalt (native)	Texas, Kentucky, Alabama, Oklahoma	Utah, Texas, Kentucky, Oklahoma.
35	Barite	Arkansas, Missouri, Nevada, Georgia	Arkansas, Missouri, Georgia, Nevada.
26	Bauxite	Arkansas, Alabama, Georgia	Arkansas, Georgia, Alabama.
69	Beryllium concentrate	South Dakota, New Mexico, Georgia, Colorado	South Dakota, Georgia, New Mexico, Maine.
24	Boron minerals	California	Rank same as for quantity.
21	Bromine	Texas, Michigan, California, West Virginia	Michigan, Texas, California, West Virginia.
85	Brucite	Nevada	Rank same as for quantity.
40	Calcium-magnesium chloride	Michigan, California, West Virginia, Ohio	Do.
71	Carbon dioxide (natural)	New Mexico, Utah, California, Washington	New Mexico, Washington, California, Oregon.
4	Cement	Pennsylvania, California, Texas, Michigan	Rank same as for quantity.
38	Chromite	Montana, California, Oregon	Do.
11	Clays	Ohio, Pennsylvania, California, Georgia	Georgia, Ohio, Pennsylvania, Wyoming.
2	Coal:		
	Bituminous	West Virginia, Pennsylvania, Kentucky, Illinois	Rank same as for quantity.
	Lignite	Montana, California, North Dakota, South Dakota	Do.
	Pennsylvania anthracite	Pennsylvania	Do.
53	Cobalt (content of ore)	Idaho, Pennsylvania	Do.
80	Columbium-tantalum concentrate	South Dakota, Colorado, New Mexico, New Hampshire.	Do.
9	Copper (in ores, etc.)	Arizona, Utah, Nevada, New Mexico	Do.
31	Diatomite	California, Nevada, Oregon, Washington	Do.
77	Emery	New York	Do.
87	Epsomite	Washington	Do.
46	Feldspar	North Carolina, Colorado, South Dakota, New Hampshire.	Do.
30	Fluorspar	Illinois, Colorado, Kentucky, Montana	Illinois, Colorado, Kentucky, Nevada.
60	Garnet (abrasive)	New York, Idaho, California, Florida	Rank same as for quantity.
66	Gem stones	Not available	California, Oregon, Texas, Nevada.
19	Gold (in ores, etc.)	South Dakota, Utah, California, Arizona	Rank same as for quantity.
82	Graphite: Amorphous	Rhode Island	Do.
23	Gypsum	Michigan, Texas, California, New York	Michigan, New York, Texas, Iowa.
47	Helium	Texas, New Mexico, Kansas	Rank same as for quantity.
61	Iodine	California	Do.
7	Iron ore (usable)	Minnesota, Michigan, Alabama, Utah	Minnesota, Michigan, Alabama, New York.
68	Iron oxide pigments	Michigan, Virginia, Illinois, New York	Rank same as for quantity.
59	Kyanite	Virginia, South Carolina	Do.
15	Lead (in ores, etc.)	Missouri, Idaho, Utah, Colorado	Do.
14	Lime (open-market)	Ohio, Missouri, Pennsylvania, Texas	Ohio, Pennsylvania, Missouri, Illinois.

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48	Lithium minerals	North Carolina, South Dakota, California, Colorado	Rank same as for quantity.
58	Magnesite	Nevada, Washington, California	Washington, Nevada, California.
25	Magnesium chloride (for magnesium metal)	Texas, Michigan	Rank same as for quantity.
34	Magnesium compounds from sea water and brines (except for metal).	California, Michigan, New Jersey, Texas	Michigan, California, New Jersey, Texas.
27	Manganese ore	Nevada, Montana, Virginia, Arkansas	Rank same as for quantity.
49	Manganiferous ore	Minnesota, New Mexico, Michigan, Nevada	Minnesota, Nevada, Michigan, New Mexico.
54	Manganiferous residuum	New Jersey	Rank same as for quantity.
75	Marl (calcareous)	Michigan, Virginia, Indiana, Wisconsin	Michigan, Nevada, California, Virginia.
73	Marl (greensand)	New Jersey, Maryland	Rank same as for quantity.
42	Mercury	California, Nevada, Idaho, Oregon	Do.
43	Mica:	North Carolina, Georgia, California, Arizona	North Carolina, Georgia, New Hampshire, South Dakota.
	Scrap	do	North Carolina, Georgia, California, South Dakota.
	Sheet	North Carolina, Connecticut, New Hampshire, Georgia.	North Carolina, New Hampshire, Georgia, South Dakota.
18	Molybdenum (content of ore and concentrate)	Colorado, Utah, Arizona, New Mexico	Rank same as for quantity.
3	Natural gas	Texas, Louisiana, Oklahoma, California	Texas, Louisiana, California, West Virginia.
6	Natural-gas liquids:		
	Natural gasoline and cycle products	Texas, California, Louisiana, Oklahoma	Rank same as for quantity.
	LP-gases	Texas, Oklahoma, California, Louisiana	Texas, California, Oklahoma, Louisiana.
65	Nickel (content of ore)	Idaho, Oregon	Oregon, Idaho.
76	Olivine	North Carolina, Washington	Rank same as for quantity.
52	Peat	Washington, Florida, Ohio, Michigan	Michigan, Ohio, New Jersey, Iowa.
55	Perlite	New Mexico, Nevada, Colorado, California	New Mexico, Colorado, Nevada, California.
1	Petroleum (crude)	Texas, California, Louisiana, Oklahoma	Rank same as for quantity.
16	Phosphate rock	Florida, Tennessee, Idaho, Montana	Do.
72	Platinum-group metals (crude)	California	Do.
17	Potassium salts	New Mexico, California, Utah, Michigan	Do.
50	Pumice and pumicite	California, New Mexico, Wyoming, Colorado	New Mexico, California, Colorado, Idaho.
37	Pyrites	Tennessee, California, Virginia, Montana	Rank same as for quantity.
62	Rare earth metals concentrate	California	Do.
12	Salt (common)	Michigan, New York, Louisiana, Texas	Michigan, New York, Ohio, Louisiana.
8	Sand and gravel	California, Michigan, New York, Texas	California, New York, Ohio, Illinois.
22	Silver (in ores, etc.)	Idaho, Utah, Montana, Arizona	Rank same as for quantity.
29	Slate	Vermont, Pennsylvania, Georgia, New York	Vermont, Pennsylvania, New York, Georgia.
28	Sodium carbonate (natural)	California, Wyoming	Rank same as for quantity.
44	Sodium sulfate (natural)	California, Texas, Wyoming	Do.
5	Stone	Pennsylvania, Ohio, Michigan, Illinois	Pennsylvania, Ohio, California, New York.
88	Strontium minerals	California	Rank same as for quantity.
10	Sulfur, from Frasch-process mines	Texas, Louisiana	Do.
56	Sulfur (from other mines)	California	Do.
32	Sulfur, recovered elemental	Wyoming, Texas, Arkansas, California	Wyoming, Texas, California, Arkansas.
45	Talc, pyrophyllite and soapstone	New York, California, North Carolina, Vermont	Rank same as for quantity.
84	Tin (content of ore and concentrate)	Colorado	Do.
	Titanium concentrate:		
36	Ilmenite	New York, Florida, Virginia	Do.
63	Rutile	Florida	Do.
89	Titanium-iron concentrate	California	Do.
57	Tripoli	Illinois, Missouri, Pennsylvania	Missouri, Illinois, Pennsylvania.
20	Tungsten concentrate	Nevada, California, North Carolina, Colorado	Rank same as for quantity.
33	Vanadium	Colorado, Utah, New Mexico, Arizona	Colorado, Utah, Arizona, New Mexico.
51	Vermiculite	Montana, South Carolina, Arizona, North Carolina	Montana, South Carolina, North Carolina, Arizona.
81	Wollastonite	New York	Rank same as for quantity.
13	Zinc (in ores, etc.)	Idaho, Montana, New York, Oklahoma	Do.
64	Zirconium concentrate	Florida	Do.

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TABLE 4.—Value of mineral production in continental United States, 1951–54, by States, in thousand dollars, and principal minerals produced in 1954

State	1951	1952	1953	1954			
				Value	Rank	Percent of U. S. total	Principal minerals in order of value
Alabama	164,280	158,382	[1] 187,087	151,330	20	1.08	Coal, iron ore, cement, stone.
Arizona	243,886	231,702	256,616	252,959	17	1.80	Copper, cement, zinc, gold.
Arkansas	119,844	117,687	127,090	131,745	21	.94	Petroleum, bauxite, sand and gravel, stone.
California	1,210,076	1,215,130	[1] 1,393,987	1,429,627	2	10.19	Petroleum, natural-gas liquids, natural gas, cement.
Colorado	179,435	187,589	211,586	256,197	15	1.83	Petroleum, molybdenum, coal, cement.
Connecticut	6,247	7,125	7,917	9,581	45	.07	Sand and gravel, stone, lime, clays.
Delaware	584	677	659	947	48	.01	Sand and gravel, stone, clays.
District of Columbia	82	7	15				Clays.
Florida	76,897	82,878	92,336	106,510	26	.76	Phosphate rock, stone, cement, clays.
Georgia	46,675	51,450	51,395	55,803	31	.40	Clays, stone, cement, sand and gravel.
Idaho	83,171	77,848	[1] 67,000	69,693	29	.50	Lead, silver, zinc, phosphate rock.
Illinois	489,934	460,005	462,443	473,077	7	3.37	Petroleum, coal, stone, sand and gravel.
Indiana	174,388	162,031	169,781	165,369	19	1.18	Coal, cement, petroleum, stone.
Iowa	47,706	52,481	51,994	58,798	30	.42	Cement, stone, sand and gravel, coal.
Kansas	400,087	403,370	413,231	449,587	8	3.20	Petroleum, natural gas, cement, stone.
Kentucky	442,264	398,446	381,742	327,503	11	2.33	Coal, petroleum, natural gas, stone.
Louisiana	787,678	848,401	965,237	996,978	3	7.11	Petroleum, natural gas, natural-gas liquids, sulfur.
Maine	8,516	8,981	10,503	10,716	44	.08	Cement, sand and gravel, stone, slate.
Maryland	26,153	26,847	27,085	30,743	39	.22	Sand and gravel, stone, cement, coal.
Massachusetts	17,077	17,812	17,191	18,851	42	.13	Stone, sand and gravel, lime, clays.
Michigan	258,471	254,518	286,487	280,150	14	2.00	Iron ore, cement, petroleum, salt.
Minnesota	432,577	397,440	542,545	351,475	10	2.50	Iron ore, sand and gravel, stone, cement.
Mississippi	103,030	101,875	107,868	110,563	25	.79	Petroleum, natural gas, sand and gravel, cement.
Missouri	135,249	140,977	128,207	131,280	22	.94	Lead, cement, stone, lime.
Montana	126,376	122,069	132,184	126,412	24	.90	Copper, petroleum, zinc, sand and gravel.
Nebraska	18,469	20,597	33,281	42,393	35	.30	Petroleum, cement, sand and gravel, stone.
Nevada	57,674	64,231	73,523	89,138	28	.63	Copper, tungsten, manganese ore, sand and gravel.
New Hampshire	1,295	1,945	1,805	2,112	46	.02	Sand and gravel, stone, feldspar, mica.
New Jersey	60,099	57,468	51,945	47,044	34	.33	Sand and gravel, stone, zinc, iron ore.
New Mexico	256,302	288,500	[1] 336,580	373,599	9	2.66	Petroleum, potassium salts, copper, natural gas.
New York	188,816	180,751	186,868	192,764	18	1.37	Cement, iron ore, stone, sand and gravel.
North Carolina	29,647	34,726	[1] 38,451	41,651	36	.30	Stone, tungsten concentrate, sand and gravel, mica.
North Dakota	10,247	12,057	19,237	22,223	40	.16	Petroleum, sand and gravel, natural-gas liquids, natural gas.
Ohio	302,612	292,689	[1] 302,242	293,659	12	2.09	Coal, stone, cement, lime.
Oklahoma	607,486	621,351	[1] 679,003	650,205	5	4.63	Petroleum, natural gas, natural-gas liquids, coal.

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Oregon	28,402	26,674	24,449	32,268	38	.23	Sand and gravel, stone, cement, diatomite.
Pennsylvania	1,289,226	1,145,633	1,121,622	925,545	4	6.60	Coal, cement, stone, natural gas.
Rhode Island	1,278	1,260	1,462	1,461	47	.01	Sand and gravel, stone, graphite.
South Carolina	11,444	14,686	17,771	17,744	43	.13	Cement, clays stone, sand and gravel.
South Dakota	29,652	30,455	[1] 33,823	37,859	37	.27	Gold, sand and gravel, stone, cement.
Tennessee	100,047	100,932	98,050	105,686	27	.75	Coal, stone, cement, phosphate rock.
Texas	3,269,199	3,379,813	3,647,913	3,730,162	1	26.58	Petroleum, natural gas, natural-gas liquids, sulfur.
Utah	257,145	265,501	298,629	255,234	16	1.82	Copper, coal, iron ore, molybdenum.
Vermont	18,516	17,891	20,302	20,483	41	.15	Stone, slate, asbestos, copper.
Virginia	161,252	164,679	152,979	129,603	23	.92	Coal, stone, cement, sand and gravel.
Washington	54,554	56,139	54,577	53,300	33	.38	Cement, sand and gravel, stone, zinc.
West Virginia	941,748	825,733	790,110	636,311	6	4.53	Coal, natural gas, stone, petroleum.
Wisconsin	48,350	55,710	[1] 55,212	54,286	32	.39	Sand and gravel, stone, iron ore, cement.
Wyoming	204,357	206,828	255,906	281,306	13	2.00	Petroleum, coal, clays, sodium salts.
Total	13,529,000	13,392,000	[1] 14,388,000	14,032,000		100.00	Petroleum, coal, natural gas, cement.

[1] Revised figure.

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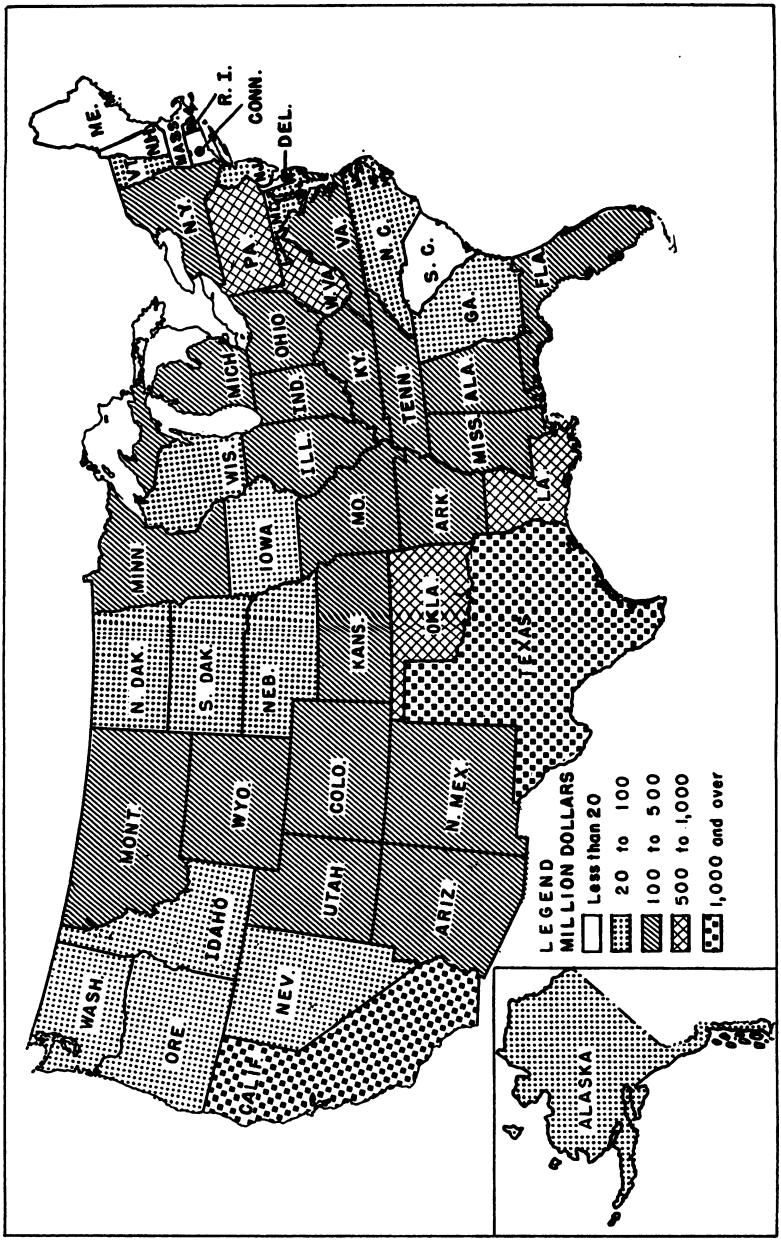

FIGURE 2.—Value of mineral production in continental United States and Alaska, 1954, by States.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]

ALABAMA

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement [2]—376-pound barrels	10, 586, 825	$24, 523, 073	10, 642, 409	$25, 084, 379	10, 427, 542	$25, 701, 421	11, 121, 599	$28, 582, 683
Clays	1, 269, 697	1, 718, 644	1, 264, 412	1, 903, 956	1, 198, 093	1, 815, 606	1, 330, 900	2, 258, 211
Coal	13, 596, 982	82, 465, 625	411, 383, 427	70, 759, 815	12, 532, 061	79, 370, 036	10, 282. 506	64, 029, 502
Iron ore (usable)—long tons, gross weight	8, 181, 737	34, 799, 951	7, 243, 214	37, 940, 412	7, 446, 130	55, 640, 338	5, 913, 462	33, 327, 083
Lime (open-market)	455, 953	4, 395, 922	424, 028	4, 458, 604	470, 541	5, 018, 156	421, 807	4, 488, 167
Natural gas (marketed production)—million cubic feet	1	50	4	160	41	2, 000	87	5, 000
Petroleum (crude)—thousand 42-gallon barrels	1, 020	(3)	1, 279	(3)	1, 694	3, 290, 000	[4] 1, 584	[4] 3, 690, 000
Sand and gravel	3, 535, 871	2, 806, 540	3, 722, 555	2, 955, 630	3, 710, 707	3, 002, 683	3, 966, 345	3, 450, 858
Stone (except for cement and lime, 1951–53)	2, 818, 421	7, 254, 671	3, 052, 150	7, 948. 410	[5] 3, 957, 452	[5] 8, 154, 467	7. 393, 530	11, 608, 937
Undistributed: Native asphalt, bauxite, pozzolan cement, graphite (1951–53), mica (1952–54), salt (1952–54), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3.) Excludes value of clays for cement (1951–53)	----------	6, 315, 082	----------	7, 330. 582	----------	[4] 5, 092, 087	----------	4. 855, 545
Total Alabama	----------	164, 280, 000	----------	158, 382, 000	----------	[6] 187, 087, 000	----------	[6] 151, 330, 000

ARIZONA

Brucite	----------	----------	----------	----------	100	$1, 250	----------	----------
Clays	226, 672	$471, 973	247, 329	$579, 175	197, 401	715, 248	253, 672	$814, 202
Coal	4, 969	29, 814	5, 003	33, 000	5, 140	32, 135	10, 925	68, 110
Copper (recoverable content of ores, etc.)	415, 870	201, 281, 080	395, 719	191, 527, 996	393, 525	225, 883, 350	377, 927	222, 976, 930
Fluorspar	1, 623	(3)	434	(3)	1, 951	113, 270	(3)	(3)
Gold (recoverable content of ores, etc.)—troy ounces	116, 093	4, 063, 255	112, 355	3, 932, 425	112, 824	3, 948, 840	114, 809	4, 018, 315
Gypsum	(3)	(3)	11, 314	28, 285	13, 484	43, 824	(3)	(3)
Lead (recoverable content of ores, etc.)	17, 394	6, 018, 324	16, 520	5, 319, 440	9, 428	2, 470, 136	8, 385	2, 297, 490
Lime (open-market)	54, 023	772, 899	53, 019	757, 390	96, 408	1, 238, 204	88, 932	1, 131, 334
Manganese ore (35 percent or more Mn)—gross weight	173	(3)	203	(3)	(3)	(3)	----------	----------
Manganiferous ore (5 to 35 percent Mn)—do	224	(3)	----------	----------	----------	----------	----------	----------
Mercury—76-pound flasks	(3)	(3)	----------	----------	----------	----------	163	43, 096
Mica (scrap)	1, 763	50. 030	(3)	(3)	3, 721	114, 870	1, 682	17, 773
Molybdenum (content of ore and concentrate)—pounds	1, 172, 740	1, 101, 641	2, 022, 832	1, 987, 418	1, 446, 557	1, 425, 552	1, 538, 088	1, 524. 936
Perlite	1, 520	10, 795	2, 747	14, 568	1, 511	9, 824	1, 296	6, 990
Pumice	(3)	(3)	(3)	(3)	123, 797	425, 985	80, 883	125, 927

For footnotes, see end of table.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]—Continued

ARIZONA—Continued

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Sand gravel	2,691,100	$2,203,345	1,824,330	$1,635,903	3,446,821	$2,680,470	3,764,080	$3,067,076
Silver (recoverable content of ores, etc.)—troy ounces	5,120,985	4,634,750	4,701,330	4,254,941	4,351,429	3,938,263	4,298,811	3,890,641
Stone (except limestone for cement and lime, 1951–53)	308,881	353,872	235,020	355,709	442,358	618,748	1,205,452	1,914,315
Tungsten concentrate—60-percent WO_3 basis	11	36,663	71	251,136	134	468,858	132	456,965
Zinc (recoverable content of ores, etc.)	52,999	19,291,636	47,143	15,651,476	27,530	6,331,900	21,461	4,635,576
Undistributed: Asbestos, barite, beryllium concentrate (1951, 1953–54), cement, diatomite (1954), feldspar, gem stones, quartz (1951–53), vanadium, vermiculite (1954), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		3,566,376		5,373,512		[4] 6,155,729		6,651,954
Total Arizona		243,886,000		231,702,000		256,616,000		[4] 252,959,000

ARKANSAS

Barite	407,085	[7] $3,765,536	428,522	[7] $3,963,828	380,763	[7] $3,945,583	370,621	$3,488,483
Bauxite—long tons, dried equivalent	1,815,274	12,259,742	1,603,833	10,235,254	1,529,976	12,975,992	1,949,368	15,993,887
Clays	491,459	1,206,858	552,576	1,513,934	529,126	1,734,414	617,450	2,556,367
Coal	1,106,705	8,686,410	873,088	6,839,113	775,207	6,143,757	477,208	3,589,217
Iron ore (usable)—long tons, gross weight	1,343	(2)	115	(2)	254	(2)	716	(2)
Lead (recoverable content of ores, etc.)	33	11,418	4	1,288				
Manganese ore (35 percent or more Mn)—gross weight	3,718	(2)	2,246	(2)	6,123	526,647	13,728	1,020,752
Manganiferous ore (5 to 35 percent Mn)—do	1,429	(2)	896	(2)				
Natural gas (marketed production)—million cubic feet	44,656	1,786,000	42,325	1,735,000	41,510	2,200,000	33,471	1,841,000
Natural-gas liquids:								
Natural gasoline and cycle products—thousand gallons	58,212	4,247,000	61,782	4,580,000	58,422	4,123,000	50,778	3,234,000
LP-gases—do	40,404	1,606,000	49,098	2,079,000	55,188	2,562,000	58,506	2,521,000
Petroleum (crude)—thousand 42-gallon barrels	29,798	73,900,000	29,440	72,420,000	29,681	77,170,000	[4] 29,130	[4] 79,520,000
Sand and gravel	3,868,940	3,569,114	5,011,095	4,977,219	4,903,835	4,955,383	6,611,860	6,566,806
Slate	27,080	174,329	(2)	(2)	34,516	315,858	41,845	379,076
Stone (except limestone for cement and lime, 1951–53)	2,535,746	3,216,426	[8] 2,967,479	[8] 3,346,201	[8] 3,545,350	[8] 5,069,750	4,604,067	5,929,638
Zinc (recoverable content of ores, etc.)	50	18,200	26	8,632				
Undistributed: Abrasive stones, cement, gypsum, lime, soapstone (1953–54), stone (dimension miscellaneous, 1952), recovered elemental sulfur, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		5,396,967		5,987,245		5,367,669		5,742,325
Total Arkansas		119,844,000		117,687,000		127,090,000		[4] 131,745,000

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Antimony ore and concentrate—gross weight			9	(2)				
Boron minerals	862, 797	$20. 030. 000	583, 828	$14, 105, 000	715, 228	$17, 668, 000	790. 449	$26. 714, 440
Cement—376-pound barrels	28, 956, 470	77, 753, 697	29, 786, 245	79, 457, 745	32, 002. 317	90. 872, 741	32, 761, 990	98. 251, 245
Chromite—gross weight	6, 302	447, 769	14, 713	[7] 1, 269, 000	26, 512	2, 078, 461	30, 661	2. 285, 250
Clays	2, 590, 040	4, 732, 124	2, 743, 130	4, 852. 266	2, 429, 888	4, 952, 723	2, 722, 850	4. 477, 174
Coal (lignite)	3, 657	37. 500	2, 998	30, 700			(2)	(2)
Copper (recoverable content of ores, etc.)	921	445, 764	800	387, 200	382	219, 268	362	213, 580
Gem stones	(9)	(2)	(9)	100, 000	(9)	(2)	(9)	(2)
Gold (recoverable content of ores, etc.)—troy ounces	339, 732	11, 890, 620	258, 176	9, 036, 160	234, 591	8, 210, 685	237. 886	8, 326. 010
Gypsum	1, 092, 883	2, 602, 758	1. 236, 430	2, 721, 134	1, 199, 489	2, 855, 983	1, 161, 502	2, 803. 862
Iron ore (usable)—long tons, gross weight	1, 182, 799	(2)	1, 463, 239	(2)	1, 697. 652	(2)	1, 270. 292	(2)
Lead (recoverable content of ores, etc.)	13. 967	4, 832, 582	11, 199	3, 606, 078	8, 664	2, 269, 968	2. 671	731, 854
Lime (open-market)	203, 344	3, 366, 959	238, 957	3, 752, 738	301, 422	4, 653, 303	212, 381	3, 387, 981
Magnesium compounds from sea water and bitterns (partly estimated) MgO equivalent	(2)	(2)	50, 277	3, 529, 362	55, 886	3, 483, 483	40, 969	2, 715, 689
Manganese ore (35 percent or more Mn)—gross weight			8, 081	(2)	5, 413	(2)	831	45, 091
Manganiferous ore (5 to 35 percent Mn)—do			56	(2)	534	10, 355	(2)	(2)
Marl, calcareous					6, 028	21, 102	5, 464	21, 965
Mercury—76-pound flasks	4, 282	899, 777	7, 241	1, 441, 683	9, 290	1, 793, 249	11, 262	2, 977, 560
Natural gas (marketed production)—million cubic feet	566, 751	82, 745, 000	517, 450	86, 414, 000	531, 346	104, 675, 000	507, 289	104, 502, 000
Natural-gas liquids:								
Natural gasoline and cycle products—thousand gallons	887, 544	65, 923, 000	870, 996	64, 945, 000	910, 350	85. 691, 000	923, 160	89. 293. 000
LP-gases—do	352, 842	15, 528. 000	393, 792	16, 700, 000	397, 572	21, 961, 000	396, 186	22. 262. 000
Peat	6, 432	42, 016	10, 527	76, 706	9. 196	73, 897	8. 090	85. 458
Perlite	(2)	(2)	(2)	(2)	15, 282	112. 790	14. 811	103. 148
Petroleum (crude)—thousand 42-gallon barrels	354, 561	797, 760, 000	359, 450	801, 570, 000	365, 085	909, 060, 000	[4] 355, 865	[4] 907, 460. 000
Pumice and pumicite	264, 411	1, 228, 569	129, 780	793, 716	433, 105	647, 910	566, 664	651, 638
Salt (common)	1. 275, 574	5, 261, 780	1, 148, 693	4, 880, 392	1, 123, 365	6, 263, 059	1, 185, 844	6, 126, 194
Sand and gravel	46, 927, 452	41, 279, 835	53, 051, 260	43, 633, 125	58, 429, 528	53, 224, 203	70, 524, 612	68, 138, 578
Silver (recoverable content of ores, etc.)—troy ounces	1, 145, 219	1, 036, 481	1, 099, 658	995, 246	1, 036, 372	937, 969	309, 575	280, 181
Stone (except limestone for cement and lime, 1951–53)	12, 537, 344	14, 714, 524	14, 374, 930	17, 697, 085	[5] 14, 497, 348	[8] 18, 472, 652	23, 303. 756	37, 541, 114
Strontium minerals					50	1, 000	12	300
Sulfur ore—long tons	(2)	(2)	(2)	(2)	152, 203	(2)	185. 085	(2)
Talc, pyrophyllite, and soapstone	[10] 126, 784	[10] 2, 269, 771	[10] 120, 574	[10] 2, 868, 255	[11] 126, 442	[11] 1, 132, 700	[11] 133, 474	[11] 1, 211. 201
Tungsten concentrate—60-percent WO_3 basis	3. 007	11, 557, 325	2, 980	11, 360, 569	2, 382	8, 939, 146	3, 512	13, 209, 371
Zinc (recoverable content of ores, etc.)	9, 602	3, 495, 128	9, 419	3, 127, 108	5, 358	1, 232, 340	1, 415	305, 640
Undistributed: Asbestos (1951, 1953–54), barite, bromine, calcium-magnesium chloride, carbon dioxide, diatomite, feldspar, abrasive garnet (1954), iodine, lithium minerals, magnesite, mica (1952 and 1954), molybdenum, platinum-group metals (crude), potassium salts, pyrites, quartz (1951–53), ground sand and sandstone (1951–53), slate, sodium carbonate and sulfate, rare earth metal concentrate (1953–54), stone (dimension limestone and crushed marble, 1953), recovered elemental sulfur, titanium-iron concentrate (non-titanium use), wollastonite (1952), and minerals whose value must be concealed for particular years indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		40, 194, 867		35, 779, 821		[8] 42, 473, 296		43, 652. 525
Total California		1, 210, 076, 000		1,215,130,000		[8] 1,393,987,000		[6] 1,429, 627, 000

For footnotes, see end of table.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]—Continued

COLORADO

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Beryllium concentrate—gross weight	97	$32,339	54	$24,588	75	$39,515	60	$27,130
Clays	657,397	1,172,109	568,730	1,087,154	777,969	1,429,780	854,791	1,002,873
Coal	4,102,639	21,165,518	3,623,015	19,215,657	3,547,850	19,197,732	2,899,791	16,078,581
Columbium-tantalum concentrate—pounds	(2)	(2)	(2)	(2)	(2)	(2)	4,967	9,897
Copper (recoverable content of ores, etc.)	3,212	1,554,608	3,606	1,745,304	2,941	1,688,134	4,523	2,668,570
Feldspar—long tons	50,451	283,153	38,268	224,385	43,508	267,642	(2)	(2)
Fluorspar	20,661	820,322	29,185	1,505,968	53,276	2,872,360	59,197	3,197,252
Gold (recoverable content of ores, etc.)—troy ounces	116,503	4,077,605	124,594	4,360,790	119,218	4,172,630	96,146	3,365,110
Gypsum	(2)	(2)	(2)	(2)	62,936	233,043	(2)	(2)
Iron ore (useable)—long tons, gross weight					900	3,825	6,049	(2)
Lead (recoverable content of ores, etc.)	30,336	10,496,256	30,066	9,681,252	21,754	5,699,548	17,823	4,883,502
Manganiferous ore (5 to 35 percent Mn)—gross weight			76	(2)				
Mica (scrap)	1,882	32,901	(2)	(2)	1,599	19,455	(2)	(2)
Molybdenum (content of ore and concentrate)—pounds	22,911,949	(2)	24,557,149	(2)	33,851,083	(2)	(2)	(2)
Natural gas—million cubic feet	14,128	608,000	34,260	1,884,000	28,509	1,654,000	45,705	3,976,000
Peat	2,241	19,611	2,312	20,230	6,067	(2)	9,028	(2)
Petroleum (crude)—thousand 42-gallon barrels	27,823	70,670,000	30,381	77,470,000	36,402	98,650,000	[4] 46,206	[4] 127,990,000
Pumice and pumicite	(2)	(2)	(2)	(2)	47,919	99,700	(2)	(2)
Sand and gravel	6,916,631	4,452,489	8,461,039	6,268,367	12,438,600	8,609,151	13,552,406	9,026,993
Silver (recoverable content of ores, etc.)—troy ounces	2,787,882	2,523,174	2,813,643	2,546,489	2,200,317	1,991,398	3,417,072	3,092,623
Stone (except limestone for cement and lime, 1951–53)	1,470,123	2,334,376	1,708,872	2,566,401	[3] [5] 884,104	[3] [5] 1,750,726	1,804,004	2,112,093
Tin (content of ore and concentrate)—long tons	18	54,033	13	33,723	(2)	(2)	(2)	(2)
Tungsten concentrate—60-percent WO_3 basis	336	1,092,780	625	2,354,664	817	2,902,490	927	3,420,563
Vanadium	5,407,161	(2)	6,751,926	(2)	7,993,922	(2)	8,516,174	(2)
Zinc (recoverable content of ores, etc.)	55,714	20,279,896	53,203	17,663,396	37,809	8,696,070	35,150	7,592,400
Undistributed: Carbon dioxide (1952–54), cement, gem stones, lithium minerals (1953–54), natural-gas liquids, perlite, stone (crushed basalt, 1953), vermiculite (1954), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		37,766,254		38,936,141		[5] 51,609,066		68,472,718
Total Colorado		179,435,000		187,589,000		[5] 211,586,000		[6] 256,197,000

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CONNECTICUT

Beryllium concentrate—gross weight					33	$14,321	13	$7,976
Clays	275,900	$252,725	157,500	$157,500	438,200	448,260	288,807	284,652
Feldspar—long tons	13,811	107,083	10,929	87,432	9,829	63,049	9,280	60,463
Peat	5,586	33,702	10,300	(2)	7,475	30,450	5,856	23,724
Quartz from pegmatites and quartzite	29,273	175,638	(2)	(2)	(2)	(2)	(12)	(12)
Sand and gravel	2,321,715	1,708,910	2,581,247	1,933,214	3,025,840	2,347,750	4,846,282	4,314,557
Stone (except limestone for lime, 1951–53)	2,278,466	3,360,378	2,837,045	4,101,060	[9] 2,826,568	[9] 4,235,327	2,829,198	4,269,430
Undistributed: Columbium-tantalum concentrate (1953–54), lime, mica, stone (dimension basalt, 1953), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		608,407		845,491		778,303		[13] 620,099
Total Connecticut		6,247,000		7,125,000		7,917,000		9,581,000

DELAWARE

Clays	35,950	$35,450	(2)	(2)	(2)	(2)	(2)	(2)
Sand and gravel	454,563	303,643	515,399	$382,484	520,817	$399,685	971,647	$752,528
Stone	99,201	245,002	94,911	251,759	80,364	215,382	(2)	(2)
Undistributed: Nonmetallic minerals and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)				42,805		43,930		194,706
Total Delaware		584,000		677,000		659,000		947,000

FLORIDA

Clays	202,821	$2,359,113	197,711	$2,071,185	257,911	$2,952,359	371,948	$3,337,130
Natural gas—million cubic feet	10	1,000	15	1,000	34	2,000	35	3,000
Peat	25,748	161,417	23,729	154,164	27,678	185,524	37,449	168,004
Petroleum (crude)—thousand 42-gallon barrels	596	(2)	591	(2)	543	(2)	[4] 548	(2)
Phosphate rock [16]—long tons	8,211,820	48,611,992	9,205,138	54,085,524	9,331,002	56,524,701	10,437,197	64,499,877
Sand and gravel	4,418,573	4,300,682	4,154,613	3,848,077	3,731,432	3,199,368	3,468,842	2,661,152
Stone (except limestone for cement and lime, 1951–53)	8,032,966	9,419,682	7,836,634	9,577,541	9,428,959	11,309,421	14,225,356	16,832,066
Titanium concentrate:								
Ilmenite—gross weight	(2)	(2)	(2)	(2)	151,109	2,322,451	157,157	2,411,823
Rutile—do	(2)	(2)	(2)	(2)	6,476	702,791	7,305	869,677
Zirconium concentrate	(2)	(2)	(2)	(2)	21,234	793,685	17,959	820,041
Undistributed: Cement, abrasive garnet, lime, stone (dimension limestone 1953–54), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		12,043,100		13,140,989		14,343,637		15,955,786
Total Florida		76,897,000		82,878,000		92,336,000		[3] 106,510,000

For footnotes, see end of table.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]—Continued

GEORGIA

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	2,603,338	$23,199,758	2,562,182	$23,137,507	2,651,153	$23,455,315	2,711,422	$24,106,926
Coal	(2)	(2)	32,100	160,500	14,100	70,500	8,090	40,450
Gold (recoverable content of ores, etc.)—troy ounces	3	105			2	70		
Iron ore (usable)—long tons, gross weight	357,754	1,339,248	319,959	1,439,251	259,964	1,100,725	221,576	871,901
Lime (open-market)	10,616	104,626	7,854	87,587	9,345	95,484	(2)	(2)
Mica (sheet)—pounds	(2)	(2)	13,010	18,852	14,063	73,806	(2)	(2)
Peat	2,250	41,000	2,150	38,000	2,305	(2)	5,150	60,920
Sand and gravel	1,226,231	1,041,561	2,133,970	2,029,367	2,051,058	1,900,987	2,703,281	2,466,352
Sand and sandstone (ground)	1,874	18,740	1,765	17,650	(2)	(2)	(15)	(15)
Stone (except limestone for cement and lime, 1951–53)	[8] 5,225,233	[8] 13,933,240	[8] 7,132,082	[8] 17,166,108	[8] 7,112,024	[8] 17,756,302	8,057,600	21,384,227
Talc and soapstone	[10] 77,895	[10] 823,133	[10] 56,491	[10] 653,144	[11] 57,891	[11] 202,619	[11] 50,536	[11] 176,876
Undistributed: Asbestos, barite, bauxite, beryllium concentrate (1952–54), cement, feldspar (1951, 1954), iron oxide pigments (1954), manganese ore (1954), scrap mica, slate, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		6,173,277		6,701,729		6,739,022		7,456,459
Total Georgia		46,675,000		51,450,000		51,395,000		[6] 55,803,000

IDAHO

Antimony ore and concentrate—gross weight	8,805	(2)	4,173	(2)	(2)	(2)	4,682	(2)
Beryllium concentrate					1	$491	(2)	(2)
Clays	28,281	$42,545	23,533	$24,683	26,229	21,339	(2)	(2)
Cobalt (content of ore)—pounds			196,516	(2)	1,211,039	(2)	1,702,272	(2)
Copper (recoverable content of ores, etc.)	2,160	1,045,440	3,213	1,555,092	3,136	1,800,064	4,828	$2,848,520
Gold (recoverable content of ores, etc.)—troy ounces	45,064	1,577,240	32,997	1,154,895	17,630	617,050	13,245	463,575
Gypsum	65	293	400	1,200	150	450	(2)	(2)
Lead (recoverable content of ores, etc.)	76,713	26,542,698	73,719	23,737,518	74,610	19,547,820	69,302	18,988,748
Mercury—76-pound flasks	357	75,016	887	176,602	(2)	(2)	609	161,013
Mica:								
Scrap			170	5,100			(2)	(2)
Sheet—pounds			20,020	115,572	24,216	223,266	(2)	(2)

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Nickel ore ..... do					21,254	(3)	25,726	(3)
Peat							500	(3)
Phosphate rock [14] ..... long tons	693,127	2,122,824	866,330	2,950,160	1,001,969	4,149,943	1,092,817	5,686,609
Pumice and pumicite	83,528	133,192	88,085	141,253	85,224	159,833	(3)	(3)
Sand and gravel	4,057,391	2,971,264	3,925,863	2,745,201	3,776,180	2,841,440	6,717,700	4,568,919
Sand and sandstone (ground)	11,968	107,738	9,500	80,000	5,304	43,865	(15)	(15)
Silver (recoverable content of ores, etc.) ..... troy ounces	14,753,023	13,352,231	14,923,165	13,506,218	14,639,740	13,249,704	15,867,414	14,360,811
Stone (except limestone for cement, 1951–53)	1,457,182	1,811,422	[8] 1,630,034	[8] 2,441,236	1,141,626	2,260,875	2,329,005	3,012,613
Titanium-iron concentrate (nontitanium use)	(3)	(3)			1,585	7,500		
Tungsten concentrate ..... 60-percent WO_3 basis	377	1,402,866	333	1,245,499	441	1,665,983	471	(3)
Zinc (recoverable content of ores, etc.)	78,121	28,436,044	74,317	24,673,244	72,153	16,595,190	61,528	13,290,048
Undistributed: Barite, cement, columbium-tantalum concentrate (1953), abrasive garnet, fluorspar (1951–53), quartz (1953), stone (crushed limestone, 1952), titanium concentrate (1951), vanadium, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		3,550,445		3,294,115		[8] 3,814,751		[13] 6,312,007
Total Idaho		83,171,000		77,848,000		[8] 67,000,000		69,693,000
ILLINOIS								
Cement ..... 376-pound barrels	8,377,387	$19,853,132	8,710,621	$20,600,347	8,651,385	$21,961,761	9,109,076	$23,147,871
Clays	2,589,464	4,026,294	2,337,023	3,871,051	2,305,202	4,573,001	2,027,092	3,482,450
Coal	54,199,875	220,547,562	45,789,982	187,827,712	46,009,891	181,597,998	41,971,136	160,213,063
Fluorspar	204,328	9,294,703	188,293	9,481,223	163,303	8,567,026	107,830	5,989,219
Lead (recoverable content of ores, etc.)	3,160	1,093,360	4,262	1,372,364	3,391	888,442	3,232	885,568
Lime (open-market)	462,690	5,878,289	460,775	5,917,038	519,992	6,986,560	532,051	7,420,849
Natural-gas (marketed production) ..... million cubic feet	11,425	1,748,000	10,183	1,650,000	9,282	1,559,000	9,475	1,345,000
Natural-gas liquids: LP-gases ..... thousand gallons	86,982	4,727,000	(3)	(3)	(3)	(3)	(3)	(3)
Peat	(3)	(3)	(3)	(3)	2,151	(3)	(3)	(3)
Petroleum (crude) ..... thousand 42-gallon barrels	60,243	166,870,000	60,089	165,850,000	59,026	170,590,000	[4] 66,798	[4] 199,060,000
Sand and gravel	20,130,567	19,146,502	19,584,308	19,214,195	21,521,806	20,540,549	24,443,055	26,164,387
Sand and sandstone (ground)	262,488	2,300,102	267,180	2,342,549	276,215	2,461,767	(15)	(15)
Silver (recoverable content of ores, etc.) ..... troy ounces	3,465	3,136	3,781	3,422	2,338	2,116	1,160	1,050
Stone (except limestone for cement and lime, 1951–53)	19,298,968	23,474,516	22,334,887	28,326,060	22,938,732	29,736,966	26,407,088	31,134,135
Zinc (recoverable content of ores, etc.)	21,776	7,926,464	18,816	6,246,912	14,556	3,347,880	14,427	3,116,232
Undistributed: Iron oxide pigments (1954), natural gasoline, recovered elemental sulfur (1953–54), tripoli, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		3,045,410		7,302,545		9,629,924		13,060,485
Total Illinois		489,934,000		460,005,000		462,443,000		[4] 473,077,000

For footnotes, see end of table.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]—Continued

INDIANA

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	1,524,731	$1,914,457	1,331,298	$1,700,209	1,654,112	$2,514,227	1,946,069	$2,990,716
Coal	19,450,445	78,617,530	16,350,202	64,977,328	15,812,485	62,353,519	13,400,188	48,913,455
Marl, calcareous (except for cement)	12,960	18,129	16,414	9,021	13,540	6,398	28,536	18,515
Natural gas—million cubic feet	845	83,000	836	79,000	701	49,000	735	44,000
Peat	5,699	22,824	10,115	49,775	6,919	41,049	12,041	59,149
Petroleum (crude)—thousand 42-gallon barrels	11,100	30,530,000	12,037	33,100,000	12,823	37,570,000	[4] 11,204	[4] 33,160,000
Sand and gravel	11,030,814	8,763,936	11,546,014	9,279,908	11,203,059	9,500,914	14,405,098	11,879,316
Stone (except limestone for cement and lime, 1951–53)	[3] 8,641,670	[3] 23,729,433	9,126,837	21,965,454	9,212,887	22,297,183	11,181,838	27,460,119
Undistributed: Abrasive stones, cement, lime, pyrites (1951–53), stone (dimension sandstone, 1951), and recovered elemental sulfur (1952–54). Excludes value of clays used for cement (1951–53)		30,708,810		30,870,155		35,448,379		42,388,935
Total Indiana		174,388,000		162,031,000		169,781,000		[4] 165,369,000

IOWA

Cement—376-pound barrels	8,024,492	$19,800,064	9,336,727	$22,849,597	9,111,358	$23,330,177	9,858,889	$27,044,464
Clays	915,802	1,061,898	864,667	2,681,789	913,413	974,539	882,849	920,859
Coal	1,630,298	6,109,776	1,380,733	5,297,074	1,388,006	5,262,373	1,196,698	4,502,561
Gypsum	1,127,705	2,881,150	1,122,409	2,797,704	1,151,692	2,939,654	1,106,626	3,035,651
Lead (recoverable content of ores, etc.)							4	1,096
Peat	13,545	107,909	14,500	110,334	17,233	(2)	(2)	(2)
Sand and gravel	9,943,372	5,916,950	10,796,979	6,032,898	10,385,322	6,400,827	12,199,656	9,276,530
Stone (except limestone for cement, 1951–53)	9,261,317	12,170,082	9,899,404	13,036,726	10,715,078	13,215,352	13,240,087	16,388,141
Undistributed: Nonmetallic minerals and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)						224,242		251,173
Total Iowa		[16] 47,706,000		[16] 52,481,000		[16] 51,994,000		[4] 58,798,000

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KANSAS

Cement [17]	376-pound barrels	8,163,916	$19,413,144	8,811,762	$20,956,886	8,546,250	$21,428,536	9,076,328	$23,874,179
Clays		731,960	728,921	665,552	789,293	670,694	749,579	(3)	(3)
Coal		1,961,101	7,734,478	2,028,601	7,902,590	1,715,004	7,101,386	1,372,294	5,602,808
Helium	cubic feet	26,280,000	327,000	38,509,000	491,000	42,782,800	563,923	37,530,000	593,163
Lead (recoverable content of ores, etc.)		8,947	3,095,662	5,916	1,904,952	3,347	876,914	4,033	1,105,042
Natural gas (marketed production)	million cubic feet	417,538	33,821,000	412,544	34,241,000	420,607	36,172,000	412,369	43,711,000
Natural-gas liquids:									
Natural gasoline	thousand gallons	111,090	6,931,000	115,206	7,286,000	(3)	(3)	(3)	(3)
LP-gases	do	68,082	2,445,000	77,406	3,116,000	(3)	(3)	(3)	(3)
Petroleum (crude)	thousand 42-gallon barrels	114,522	294,320,000	114,807	293,910,000	114,566	308,180,000	[4] 119,317	[4] 335,280,000
Pumicite		(3)	(3)	(3)	(3)	(3)	(3)	23,433	92,899
Salt (common)		900,917	6,639,343	911,744	6,850,027	905,227	7,480,556	876,667	7,778,406
Sand and gravel		7,676,888	4,747,544	8,380,065	5,023,593	8,728,291	5,668,308	10,421,554	7,194,171
Stone (except limestone for cement, 1951–53)		7,191,483	9,058,512	8,830,871	12,051,740	8,769,152	11,303,950	10,377,008	12,941,822
Zinc (recoverable content of ores, etc.)		28,904	10,521,056	25,482	8,460,024	15,515	3,568,450	19,110	4,127,760
Undistributed: Natural cement, gypsum, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)			303,946		386,847		10,137,870		9,721,342
Total Kansas			400,087,000		403,370,000		413,231,000		[4] 449,587,000

KENTUCKY

Clays	880,240	$5,274,285	880,874	$5,101,266	711,209	$3,118,352	571,481	$2,994,926
Coal	74,972,335	366,686,901	66,114,341	317,386,725	65,060,478	302,871,877	56,964,408	236,736,940
Fluorspar	68,635	2,334,485	48,308	1,863,262	47,244	2,100,493	35,831	1,510,344
Lead (recoverable content of ores, etc.)	107	37,022	60	19,320	52	13,624	80	21,920
Natural gas (marketed production) million cubic feet	76,097	16,513,000	73,427	15,934,000	71,405	15,638,000	72,713	16,579,000
Natural-gas liquids:								
Natural gasoline thousand gallons	11,130	799,000	30,660	2,191,000	35,406	2,394,000	28,224	1,552,000
LP-gases do	79,842	2,129,000	156,198	3,963,000	176,232	4,993,000	189,966	5,066,000
Petroleum (crude) thousand 42-gallon barrels	11,622	32,190,000	11,918	32,890,000	11,518	33,520,000	[4] 13,791	[4] 40,270,000
Sand and gravel	2,801,639	2,434,799	3,334,261	2,656,053	3,052,155	2,899,932	4,729,606	4,401,793
Stone (except limestone for cement, 1951–53)	7,048,771	8,609,609	[5] 8,817,859	[5] 10,816,707	[5] 7,429,505	[5] 9,268,237	10,129,725	13,285,786
Zinc (recoverable content of ores, etc.)	3,457	1,258,348	3,280	1,088,960	489	112,470	458	98,928
Undistributed: Native asphalt, cement, stone (dimension sandstone, 1952–53.) Excludes value of clays used for cement (1951–53)		3,997,061		4,535,564		4,811,752		5,625,951
Total Kentucky		442,264,000		398,446,000		381,742,000		[4] 327,503,000

For footnotes, see end of table.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]—Continued

LOUISIANA

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	306,542	$306,542	390,136	$433,808	624,427	$951,612	(2)	(2)
Natural gas (marketed production)—million cubic feet	1,054,199	61,143,000	1,237,143	82,889,000	1,293,644	106,079,000	1,399,222	$124,531,000
Natural-gas liquids:								
Natural gasoline and cycle products—thousand gallons	657,006	49,202,000	672,042	48,579,000	665,532	55,421,000	665,070	54,330,000
LP-gases—do	287,238	15,374,000	297,444	14,890,000	287,280	12,654,000	292,226	11,620,000
Petroleum (crude)—thousand 42-gallon barrels	232,281	614,680,000	243,929	645,090,000	256,632	721,150,000	[4] 246,558	[4] 722,370,000
Salt (common)	2,737,149	7,662,179	2,553,448	7,807,693	3,061,234	9,189,526	3,088,686	11,101,456
Sand and gravel	6,384,328	7,419,570	6,005,119	6,736,524	4,538,387	5,162,248	7,910,152	9,686,635
Sulfur (Frasch-process)—long tons	1,152,821	25,400,000	1,449,668	32,015,000	1,609,364	43,453,000	1,853,563	49,222,394
Undistributed: Cement, gypsum, lime (1953–54), stone (except limestone for cement, 1952; and crushed limestone, 1954), recovered elemental sulfur (1952–54), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		6,490,595		9,959,888		11,176,929		14,367,681
Total Louisiana		787,678,000		848,401,000		965,237,000		[12] 996,978,000

MAINE

Cement—376-pound barrels	1,236,299	$3,182,918	1,457,250	$3,750,483	2,001,464	$5,422,272	1,973,249	$5,425,184
Clays	21,885	21,885	26,050	26,050	29,661	27,476	26,872	26,872
Feldspar—long tons	19,273	154,695	18,644	147,371	17,637	117,090	(3)	(3)
Peat	1,805	36,870	1,695	57,541	2,428	73,564	2,350	99,831
Sand and gravel	5,366,694	1,817,317	7,078,078	2,187,531	8,071,937	2,608,386	7,460,620	2,538,143
Stone (except limestone for cement and lime, 1951–53)	644,594	2,582,541	[8] 316,874	[8] 1,795,768	[8] 248,501	[8] 1,215,439	1,023,709	2,355,385
Undistributed: Beryllium concentrate, columbium-tantalum concentrate (1951, 1953–54), gem stones (1951 and 1954), lime, mica, quartz from pegmatites or quartzite (1951–53), slate, stone (crushed limestone, 1952–53), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		720,095		1,015,827		1,038,883		801,14
Total Maine		8,516,000		8,981,000		10,503,000		[12] 10,716,000

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MARYLAND

Clays	756,987	$1,414,342	771,922	$1,426,556	[8] 671,164	[8] $1,135,700	627,311	$1,165,747
Coal	588,639	2,781,343	587,903	2,694,842	530,590	2,441,605	421,616	1,879,018
Gold (recoverable content of ores, etc.)—troy ounces	1	35						
Lime (open-market)	67,684	722,011	72,885	746,893	71,705	707,736	67,081	685,427
Natural gas (marketed production)—million cubic feet	3,422	684,000	2,372	460,000	1,408	268,000	1,394	282,000
Sand and gravel	7,054,488	8,170,851	6,956,640	8,136,697	7,379,511	8,919,088	10,097,800	12,171,613
Stone (except limestone for cement and lime, 1951–53)	3,181,434	5,983,380	[8] 3,391,679	[8] 6,330,443	[8] 3,578,250	[8] 6,275,124	5,064,526	8,265,521
Undistributed: Beryllium concentrate (1954), cement, greensand marl (1954), mica (1954), potassium salts, quartz (1952), slate, stone, (dimension limestone and crushed marble, 1952–53), recovered elemental sulfur (1951), and talc and soapstone. Excludes value of clays used for cement (1951–53)		6,396,886		7,051,145		7,337,486		7,288,888
Total Maryland		26,153,000		26,847,000		27,085,000		[8] 30,743,000

MASSACHUSETTS

Clays	150,370	$167,646	140,148	$160,371	152,117	$195,837	128,998	$121,049
Lime (open-market)	143,316	1,930,225	132,135	1,999,545	135,383	2,156,205	127,836	1,709,341
Peat	[3]	[3]	[3]	[3]	2,061	15,962	[3]	[3]
Quartz from pegmatites and quartzite	2,186	17,489	[3]	[3]	[3]	[3]	[12]	[12]
Sand and gravel	7,232,088	5,592,640	7,645,728	6,128,744	7,308,190	5,930,894	9,640,274	8,366,409
Stone (except limestone for lime, 1951–53)	[8] 3,225,839	[8] 9,172,425	[8] 3,355,819	[8] 9,331,871	3,457,708	8,821,108	2,942,435	9,039,590
Undistributed: Nonmetallic minerals		196,694		191,752		71,368		12,077
Total Massachusetts		17,077,000		17,812,000		17,191,000		[13] 18,851,000

MICHIGAN

Cement—376-pound barrels	14,112,639	$35,121,324	14,760,783	$36,819,042	15,853,096	$41,860,464	16,711,710	$45,691,867
Clays	1,511,087	1,581,815	1,775,917	1,810,916	1,645,804	1,686,113	1,870,814	1,919,204
Coal	7,347	74,861						
Copper (recoverable content of ores, etc.)	24,979	12,089,836	21,699	10,502,316	24,097	13,831,678	23,593	13,919,870
Gypsum	1,566,276	4,402,725	1,487,642	4,200,418	1,446,973	4,091,002	1,693,279	5,035,550
Iron ore (usable)—long tons, gross weight	13,611,621	81,765,748	11,779,366	76,088,935	13,312,766	94,691,612	9,709,167	70,004,504
Magnesium compounds from well brines (partly estimated) MgO equivalent	38,306	4,355,820	38,449	3,917,138	43,190	4,591,922	37,038	4,103,766
Manganiferous ore (5 to 35 percent Mn)—gross weight	69,626	[3]	22,095	[3]	76,251	[3]	15,361	[3]
Marl, calcareous (except for cement)	178,010	96,639	164,519	86,529	183,685	72,781	106,668	37,724
Natural gas (marketed production)—million cubic feet	11,194	1,657,000	9,052	1,322,000	7,774	1,275,000	6,962	1,239,000
Peat	20,180	320,100	29,304	419,856	25,439	257,176	27,847	429,116
Petroleum (crude)—thousand 42-gallon barrels	13,927	37,880,000	13,251	35,250,000	12,285	35,870,000	[4] 12,028	[4] 35,600,000
Salt (common)	5,137,639	21,221,330	4,778,347	21,446,382	5,127,387	22,171,988	5,063,633	29,396,312
Sand and gravel	27,540,921	20,976,632	29,193,763	22,400,879	30,459,663	23,170,802	32,040,639	25,516,169

For footnotes, see end of table.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]—Continued

MICHIGAN—Continued

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Stone (except limestone for cement and lime, 1951–53)	20,851,733	$17,514,720	17,973,685	$15,770,816	21,615,686	$17,639,525	27,758,443	$21,904,517
Undistributed: Bromine, calcium-magnesium chloride, iron oxide pigments (1954), lime, magnesium chloride (for metal), natural-gas liquids (natural gasoline, LP-gases, 1952–54), potassium salts, ground sand and sandstone (1951–53), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		19,412,250		24,482,809		25,276,772		29,052,541
Total Michigan		258,471,000		254,518,000		286,487,000		[6] 280,150,000

MINNESOTA

Clays	129,942	$187,605	113,492	$160,408	91,401	$149,384	(3)	(3)
Iron ore (usable)—long tons, gross weight	78,164,527	411,468,895	63,906,069	375,765,251	80,533,670	517,850,509	48,613,338	$319,632,491
Manganiferous ore (5 to 35 percent Mn)—gross weight	1,010,651	(3)	912,118	(3)	1,091,491	(3)	504,057	(3)
Marl, calcareous (except for cement)	2,925	1,549	1,449	722	(3)	(3)	(3)	(3)
Sand and gravel	17,229,526	6,008,994	19,825,157	6,808,763	19,774,411	7,304,351	23,848,856	16,318,520
Stone (except limestone for cement and lime, 1951–53)	[5] 1,906,407	[5] 5,613,157	[5] 2,394,178	[5] 5,498,177	2,270,528	6,587,096	[5] 2,629,456	[5] 7,485,291
Undistributed: Abrasive stones, cement, iron oxide pigments (1954), lime, peat (1954), stone (crushed sandstone, 1951 and 1954 and crushed basalt, 1952) and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		9,296,790		9,206,865		10,653,888		8,205,868
Total Minnesota		432,577,000		397,440,000		542,545,000		[13] 351,475,000

MISSISSIPPI

Clays	673,078	$4,250,253	509,099	$2,681,563	560,047	$3,158,385	559,401	$3,103,132
Natural gas (marketed production)—million cubic feet	158,845	10,007,000	174,100	10,620,000	154,254	12,340,000	140,448	11,657,000
Natural-gas liquids:								
Natural gasoline and cycle products—thousand gallons	30,618	2,503,000	33,726	2,606,000	32,214	2,295,000	27,804	1,944,000
LP-gases—do	19,866	852,000	19,614	777,000	17,724	713,000	15,288	528,000
Petroleum (crude)—thousand 42-gallon barrels	37,039	82,970,000	36,310	80,970,000	35,620	84,060,000	[4] 34,240	[4] 85,600,000

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Sand and gravel	3,012,152	2,279,034	2,296,577	1,833,306	2,653,646	2,173,871	5,441,837	4,286,871
Stone	171,131	168,933	90,000	103,500	38,000	43,700	91,218	[4] 181,418
Undistributed: Nonmetallic minerals. Excludes value of clays used for cement (1951–53)				2,283,312		3,083,749		3,352,481
Total Mississippi		103,030,000		101,875,000		107,868,000		[12] 110,563,000

MISSOURI

Barite	281,895	$2,697,290	304,080	$2,919,795	330,763	$3,338,395	312,791	$3,047,436
Cement—376-pound barrels	10,217,421	25,760,473	10,086,850	25,523,038	9,860,179	26,238,460	11,379,257	31,425,190
Clays	2,354,857	10,558,438	2,991,019	12,098,420	2,231,596	11,182,096	1,927,285	5,858,756
Coal	3,269,283	13,405,436	2,954,450	12,048,141	2,393,304	9,848,903	2,513,593	10,028,293
Copper (recoverable content of ores, etc.)	2,422	1,172,248	2,576	1,246,784	2,374	1,362,676	1,925	1,135,750
Iron ore (usable)—long tons, gross weight	172,466	(3)	268,218	(3)	274,693	(3)	173,394	(3)
Lead (recoverable content of ores, etc.)	123,702	42,800,892	129,245	41,616,890	125,895	32,984,490	125,250	34,318,500
Lime (open-market)	1,122,299	11,285,877	1,130,970	11,326,941	1,212,107	12,084,130	1,125,919	11,165,381
Natural gas (marketed production)—million cubic feet	14	2,000	16	3,000	15	3,000	16	(3)
Petroleum (crude)—thousand 42-gallon barrels	24	(3)	21	(3)	39	(3)	(3)	(3)
Sand and gravel	6,809,857	5,969,849	6,790,422	6,122,195	5,792,058	5,233,999	9,891,305	10,203,481
Silver (recoverable content of ores, etc.)—troy ounces	184,424	166,913	517,432	468,302	359,781	325,620	352,971	319,457
Stone (except limestone for cement and lime, 1951–53)	11,294,227	15,255,427	15,106,544	20,676,958	[5] 13,947,834	[5] 20,552,840	18,615,739	24,695,110
Zinc (recoverable content of ores, etc.)	11,476	4,177,264	13,986	4,643,352	9,981	2,295,630	5,210	1,125,360
Undistributed: Native asphalt, manganese ore (1953–54), ground sand and sandstone (1951–53), stone (dimension marble, 1953), tripoli, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		1,997,134		2,283,550		[6] 2,756,746		2,908,454
Total Missouri		135,249,000		140,977,000		128,207,000		[6] 131,280,000

MONTANA

Antimony ore and concentrate—gross weight	29	(3)			(3)	(3)		
Chromite—do					26,089	$869,958	123,096	$4,132,475
Clays	39,231	$41,631	51,304	$73,601	36,994	38,312	(3)	(3)
Coal:								
Bituminous	2,310,348	6,038,638	2,038,808	5,698,778	1,848,334	4,884,209	1,490,846	4,157,325
Lignite	35,070	123,263	30,550	112,953	24,803	93,551	(3)	(3)
Copper (recoverable content of ores, etc.)	57,406	27,784,504	61,948	29,982,832	77,617	44,552,158	59,349	35,015,910
Fluorspar			16,160	(3)	5,932	(3)	15,102	(3)
Gold (recoverable content of ores, etc.)—troy ounces	30,502	1,067,570	24,161	845,635	24,768	866,880	23,660	828,100
Iron ore (usable)—long tons, gross weight					6,709	45,083	6,473	(3)
Lead (recoverable content of ores, etc.)	21,302	7,370,492	21,279	6,851,838	19,949	5,226,638	14,820	4,060,680
Manganese ore (35 percent or more Mn)—gross weight	100,562	(3)	100,070	(3)	113,429	(3)	58,661	(3)
Manganiferous ore (5 to 35 percent Mn)—do	7,598	(3)	9,357	(3)	5,598	(3)	5,266	(3)
Natural gas (marketed production)—million cubic feet	36,424	2,003,000	28,714	1,752,000	27,889	1,645,000	30,252	2,057,000

For footnotes, see end of table.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]—Continued

MONTANA—Continued

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Natural-gas liquids:								
Natural gasoline—thousand gallons	4,746	$392,000	[2]	[2]	[2]	[2]	[2]	[2]
LP-gases—do	6,888	481,000	[2]	[2]	[2]	[2]	[2]	[2]
Petroleum (crude)—thousand 42-gallon barrels	8,958	22,130,000	9,606	$21,610,000	11,920	$26,020,000	[4] 14,195	[4] $31,230,000
Pumice and pumicite	[3]	[3]			3,000	15,000	175	920
Sand and gravel	9,582,843	6,201,888	6,765,955	3,579,932	6,203,480	2,993,575	13,340,544	7,460,260
Silver (recoverable content of ores, etc.)—troy ounces	6,393,768	5,786,683	6,138,185	5,555,367	6,689,556	6,054,386	5,177,942	4,686,299
Stone (except limestone for cement and lime, 1951–53)	871,508	986,327	[5] 690,081	[5] 792,897	[5] 802,735	[5] 1,124,731	1,319,829	1,385,239
Tungsten concentrate—60-percent WO_3 basis	1	2,832			14	[3]	678	[3]
Zinc (recoverable content of ores, etc.)	85,551	31,140,564	82,185	27,285,420	80,271	18,462,330	60,952	13,165,632
Undistributed: Barite, cement, gem stones (1951 and 1954), gypsum lime, sheet mica (1954), phosphate rock, pyrites, sodium sulfate (1951) stone (dimension granite, 1952–53), talc, vermiculite, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		14,825,330		17,928,016		19,292,629		18,518,856
Total Montana		126,376,000		122,069,000		132,184,000		[13] 126,412,000

NEBRASKA

Clays	115,845	$116,345	167,228	$167,703	175,856	$186,893	163,831	$163,831
Natural gas (marketed production)—million cubic feet	3,895	499,000	5,568	740,000	6,748	911,000	6,801	796,000
Petroleum (crude)—thousand 42-gallon barrels	2,558	5,960,000	2,260	6,490,000	6,344	17,190,000	[4] 7,783	[4] 21,400,000
Sand and gravel	4,969,243	3,477,409	5,436,540	3,874,106	5,969,858	4,340,163	8,547,876	6,992,314
Stone (except limestone for cement, 1951–53)	942,967	1,437,899	1,245,106	1,946,448	1,407,158	2,069,984	2,660,170	3,511,494
Undistributed: Cement, natural-gas liquids, and pumice and pumicite. Excludes value of clays used in cement (1951–53)		6,978,760		7,378,888		8,582,904		10,637,123
Total Nebraska		18,469,000		20,597,000		33,281,000		[6] 42,393,000

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NEVADA

Antimony ore and concentrate—gross weight	156	(2)	152	(2)	20	(2)	4	(2)
Barite	63,201	$387,026	68,062	$391,242	99,525	$614,686	83,833	$517,492
Clays	3,220	33,420	3,958	36,278	(3)	(3)	5,478	8,787
Copper (recoverable content of ores, etc.)	56,474	27,333,416	57,537	27,847,908	61,850	35,501,900	70,217	41,428,030
Gold (recoverable content of ores, etc.)—troy ounces	121,036	4,236,260	117,203	4,102,105	101,799	3,562,965	79,067	2,767,345
Gypsum	643,637	1,811,757	608,284	1,666,938	701,584	1,975,053	654,422	2,217,273
Iron ore (usable)—long tons, gross weight	299,010	898,306	911,657	3,991,970	444,081	2,647,859	351,250	2,024,794
Lead (recoverable content of ores, etc.)	7,148	2,473,208	6,790	2,186,380	4,371	1,145,202	3,041	833,234
Manganese ore (35 percent or more Mn)—gross weight	328	(3)	695	(3)	20,150	1,684,555	(3)	(3)
Manganiferous ore (5 to 35 percent Mn)—do	1,250	(3)	7,947	(3)	25,064	431,559	12,870	165,075
Mercury—76-pound flasks	1,400	294,182	3,523	701,429	3,254	628,120	4,974	1,315,076
Petroleum (crude)—thousand 42-gallon barrels							33	40,000
Pumice and pumicite	(3)	(3)	(3)	(3)	21,269	86,366	(3)	(3)
Sand and gravel	2,616,629	2,657,654	2,098,211	2,380,419	2,266,064	2,088,948	3,531,291	2,956,537
Silver (recoverable content of ores, etc.)—troy ounces	981,669	888,460	941,195	851,829	697,086	630,898	560,182	506,993
Stone (except limestone for lime, 1951–53)	834,807	959,815	830,712	1,158,608	1,035,568	1,399,529	1,832,781	2,010,592
Talc and soapstone	[10] 6,919	[10] 152,878	[10] 7,580	[10] 180,328	[11] 10,906	[11] 72,971	[11] 5,866	[11] 53,582
Tungsten concentrate—60-percent WO_3 basis	1,482	4,780,237	2,329	8,820,598	3,683	13,824,238	5,331	20,048,448
Zinc (recoverable content of ores, etc.)	17,443	6,349,252	15,357	5,098,524	5,812	1,336,760	1,035	223,560
Undistributed: Brucite, diatomite, fluorspar, gem stones (1952–54), lime, magnesite, calcareous marl, molybdenum, perlite, salt, sulfur ore (1951–53), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		4,418,333		4,816,659		5,891,368		12,435,000
Total Nevada		57,674,000		64,231,000		73,523,000		[12] 89,138,000

NEW HAMPSHIRE

Beryllium concentrate—gross weight	50	$16,670	(3)	(3)	57	$32,640	12	$6,960
Clays	28,501	28,501	30,135	$30,135	45,198	41,427	35,681	35,681
Columbium-tantalum concentrate—pounds, gross weight					770	1,309	255	433
Feldspar—long tons	(3)	(3)	(3)	(3)	28,961	286,069	(3)	(3)
Mica:								
Sheet—pounds			(3)	(3)	90,716	382,680	42,466	234,450
Scrap	(3)	(3)	(3)	(3)	(3)	(3)	325	11,583
Sand and gravel	2,260,410	517,927	3,200,232	1,001,591	2,249,001	506,156	2,240,548	1,094,474
Stone	[8] 62,355	[8] 349,606	69,850	546,177	76,701	538,897	72,486	473,298
Undistributed: Abrasive stones, peat, stone (crushed granite, 1951), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		382,691		366,597		15,617		255,226
Total New Hampshire		1,295,000		1,945,000		1,805,000		2,112,000

For footnotes, see end of table.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]—Continued

NEW JERSEY

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	683,439	$2,106,628	598,775	$1,962,599	532,185	$1,326,297	578,344	$1,246,099
Iron ore (usable)—long tons, gross weight	657,930	7,810,776	685,466	6,760,467	815,905	10,114,970	476,192	6,621,881
Manganiferous residuum—gross weight	267,751	(3)	215,255	(3)	293,758	(3)	214,931	(3)
Marl (greensand)	5,067	263,944	4,600	177,847	6,821	193,404	2,101	184,834
Peat	27,678	213,500	21,800	191,664	21,706	(3)	(3)	(3)
Sand and gravel	6,652,383	9,106,052	7,060,074	9,473,428	7,361,935	10,835,948	10,005,325	14,704,474
Sand and sandstone (ground)	144,098	1,053,991	138,434	1,011,844	127,921	918,534	(16)	(17)
Stone (except limestone for lime, 1951–53)	6,457,248	10,987,705	6,102,324	12,307,480	6,036,259	13,307,856	5,772,200	12,109,950
Zinc (recoverable content of ores, etc.) [18]	62,917	24,279,745	59,190	21,520,612	45,700	9,922,990	37,416	7,992,058
Undistributed: Lime, magnesium compounds, recovered elemental sulfur, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		4,276,783		4,061,840		5,325,148		[18] 4,184,432
Total New Jersey		60,099,000		57,468,000		51,945,000		47,044,000

NEW MEXICO

Beryllium concentrate—gross weight	141	$47,008	101	$29,185	89	$52,014	117	$43,771
Clays	75,653	148,876	57,668	107,633	49,089	103,931	47,832	83,085
Coal	782,698	4,501,842	759,437	4,382,286	513,781	3,081,366	123,099	727,372
Columbium-tantalum concentrate—pounds, gross weight					(3)	(3)	2,093	3,558
Copper (recoverable content of ores, etc.)	73,558	35,602,072	76,112	36,838,208	72,477	41,601,798	60,558	35,729,220
Fluorspar	24,402	1,163,098	16,443	823,320	11,890	(3)	8,876	(3)
Gold (recoverable content of ores, etc.)—troy ounces	3,959	138,565	2,949	103,215	2,614	91,490	3,539	123,865
Gypsum							887	2,661
Helium—cubic feet					11,158,000	150,127	41,754,600	735,183
Iron ore (usable)—long tons, gross weight	32,210	(3)	7,793	(3)	7,525	(3)	3,316	(3)
Lead (recoverable content of ores, etc.)	5,846	2,022,716	7,021	2,260,762	2,943	771,066	887	243,038
Manganese ore (35 percent or more Mn)—gross weight	226	(3)	2,360	(3)				
Manganiferous ore (5 to 35 percent Mn)—do	79,844	(3)	52,934	(3)	(3)	(3)	20,546	82,184
Natural gas (marketed production)—million cubic feet	300,169	11,406,000	359,377	16,414,000	399,086	24,344,000	449,346	35,049,000
Natural-gas liquids:								
Natural gasoline and cycle products—thousand gallons	138,894	10,507,000	163,926	11,660,000	171,654	10,094,000	224,112	11,744,000
LP-gases—do	95,802	3,170,000	114,408	3,600,000	121,212	4,618,000	225,994	5,704,000
Perlite	(3)	(3)	(3)	(3)	84,891	661,698	111,040	885,824
Petroleum (crude)—thousand 42-gallon barrels	52,719	129,160,000	58,681	144,340,000	70,441	185,260,000	[4] 74,820	[4] 205,760,000

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Potassium salts—K_2O equivalent	1, 217, 617	37, 209, 740	1, 411, 125	46, 385, 452	1, 552, 831	[5] 58, 076, 435	1, 732, 240	64, 366, 641
Pumice and pumicite	245, 564	884, 311	217, 482	755, 139	528, 649	759, 840	363, 926	1, 060, 096
Salt (common)	(3)	(3)	(3)	(3)	62, 087	216, 364	50, 669	333, 255
Sand and gravel	1, 080, 256	1, 087, 857	496, 921	499, 589	1, 416, 390	1, 238, 979	6, 519, 339	8, 340, 251
Silver (recoverable content of ores, etc.)—troy ounces	443, 267	401, 179	479, 318	433, 807	205, 309	185, 815	109, 132	98, 770
Stone	1, 022, 901	592, 179	[5] 317, 894	[5] 191, 642	624, 528	510, 713	771, 630	714, 037
Tungsten concentrate—60-percent WO_3 basis							(15)	1, 414
Zinc (recoverable content of ores, etc.)	45, 419	16, 532, 516	50, 975	16, 923, 700	13, 373	3, 075, 790	6	1, 296
Undistributed: Barite, carbon dioxide, diatomite (1953–54), gem stones, sheet mica (1954), molybdenum, stone (crushed miscellaneous, 1952), recovered elemental sulfur (1953-54), vanadium, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		1, 726, 948		2, 151, 749		1, 686, 990		1, 766, 267
Total New Mexico		256, 302, 000		288, 500, 000		[5] 336, 580, 000		373, 599, 000

NEW YORK

Cement [17]—376-pound barrels	13, 862, 522	$34, 687, 090	14, 624, 274	$36, 679, 379	14, 965, 164	$39, 388, 183	14, 496, 876	$38, 861, 205
Clays	1, 559, 472	1, 632, 878	1, 218, 850	1, 291, 736	960, 791	1, 303, 281	1, 199, 158	1, 493, 503
Emery	11, 634	160, 212	10, 352	141, 911	10, 562	143, 974	9, 758	132, 313
Gypsum	1, 259, 484	4, 010, 766	1, 143, 920	3, 816, 148	987, 156	3, 507, 207	1, 133, 579	4, 005, 353
Iron ore (usable)—long tons, gross weight	3, 649, 531	39, 819, 368	2, 896, 531	34, 514, 879	3, 414, 859	36, 346, 279	2, 802, 873	31, 706, 570
Lead (recoverable content of ores, etc.)	1, 500	519, 000	1, 120	360, 640	1, 435	375, 970	1, 187	325, 238
Natural gas (marketed production)—million cubic feet	3, 214	807, 000	3, 267	1, 059, 000	2, 347	742, 000	2, 598	847, 000
Peat			(3)	(3)	3, 775	46, 307	(3)	(3)
Petroleum (crude)—thousand 42-gallon barrels	4, 254	17, 990, 000	4, 242	17, 940, 000	3, 800	16, 260, 000	[4] 3, 257	[4] 11, 140, 000
Salt (common)	3, 518, 715	16, 552, 890	3, 417, 443	16, 746, 462	3, 322, 659	17, 351, 111	3, 412, 636	22, 754, 118
Sand and gravel	21, 008, 701	19, 285, 299	20, 270, 058	18, 287, 623	22, 530, 891	23, 493, 857	30, 082, 333	29, 756, 301
Silver (recoverable content of ores, etc.)—troy ounces	47, 568	43, 051	38, 895	35, 202	35, 398	32, 037	34, 576	31, 293
Slate	126, 070	2, 000, 106	125, 930	1, 810, 865	113, 575	1, 733, 332	114, 929	1, 742, 048
Stone (except limestone for cement and lime, 1951–53)	15, 559, 372	24, 326, 118	16, 234, 549	25, 244, 245	[5] 15, 961, 657	[5] 25, 250, 576	19, 410, 121	31, 425, 701
Talc	[10] 152, 652	[10] 4, 170, 987	[10] 149, 837	[10] 4, 069, 771	[11] 156, 299	[11] 940, 541	(3)	(3)
Zinc (recoverable content of ores, etc.)	40, 051	14, 578, 564	32, 636	10, 835, 152	51, 529	11, 851, 670	53, 199	11, 490, 984
Undistributed: Abrasive stone (1953–54), beryllium concentrate (1954), natural cement, abrasive garnet, iron oxide pigments (1954), lime, calcareous marl, pyrites (1951–52), stone (crushed unclassified, 1953), recovered elemental sulfur (1951–52), titanium concentrate, wollastonite, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		8, 232, 758		7, 917, 911		8, 102, 030		9, 908, 988
Total New York		188, 816, 000		180, 751, 000		186, 868, 000		[6] 192, 764, 000

For footnotes, see end of table.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]—Continued

NORTH CAROLINA

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Abrasive stones	(2)	$13,263	(2)	$28,992	(2)	$16,150	587	$12,125
Clays	1,462,030	2,177,515	1,357,700	2,080,172	1,466,232	2,534,908	1,872,541	2,519,721
Coal	(3)	(3)	1,600	12,684				
Copper (recoverable content of ores, etc.)							(10)	106
Feldspar—long tons	166,361	1,230,404	240,364	2,416,031	268,042	3,290,495	230,744	2,220,707
Gold (recoverable content of ores, etc.)—troy ounces							214	7,490
Lead (recoverable content of ores, etc.)							4	1,049
Mica:								
Scrap	52,550	1,441,886	58,576	1,551,071	56,834	1,428,793	61,049	1,457,122
Sheet—pounds	464,949	127,204	595,331	664,075	619,895	1,308,494	479,221	1,787,197
Sand and gravel	7,656,370	4,435,702	8,724,748	5,665,169	6,910,982	4,992,991	7,441,200	5,508,284
Silver (recoverable content of ores, etc.)—troy ounces							438	396
Stone	[8] 8,612,967	[8] 13,292,690	[8] 9,647,513	[8] 14,694,698	[8] 9,317,390	[8] 14,424,323	10,133,728	15,625,331
Talc and pyrophyllite	[10] 113,950	[10] 1,982,927	[10] 115,481	[10] 1,771,518	[11] 119,341	[11] 578,239	[11] 112,704	[11] 388,428
Tin (content of ore and concentrate)—long tons	1	1,724	4	11,601				
Titanium concentrate (ilmenite)—gross weight	(3)	(3)	25,328	177,296				
Tungsten concentrate—60-percent WO_3 basis	1,041	(3)	1,254	(3)	2,074	(3)	2,538	(3)
Undistributed: Abrasive stone (millstones, 1954), asbestos (1951, 1953–54), beryllium concentrate (1951, 1953–54), columbium-tantalum concentrate (1952–53), lithium minerals, manganiferous ores (1953), olivine, quartz (1951–53), stone (dimension marble, 1951–53, and crushed marble, 1952–53, vermiculite, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		4,944,042		5,652,311		[5] 9,876,773		12,122,942
Total North Carolina		29,647,000		34,726,000		[5] 38,451,000		41,651,000

NORTH DAKOTA

Clays	18,250	$35,250	(3)	(3)	23,084	$47,862	(3)	(3)
Coal (lignite)	3,224,027	7,784,191	2,983,752	$7,068,259	2,802,558	6,617,980	(3)	(3)
Natural gas (marketed production)—million cubic feet	456	24,000	369	23,000	498	34,000	1,093	$69,000
Petroleum (crude)—thousand 42-gallon barrels	25	(3)	1,549	(3)	5,183	10,370,000	[6] 6,025	[6] 12,890,000
Sand and gravel	4,573,341	2,140,466	6,557,069	1,841,216	6,173,737	2,164,685	7,105,466	2,219,747
Stone	281,219	213,061	67,064	4,968	35,031	2,595	1,419	3,784
Undistributed: Nonmetallic minerals and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		50,000		3,119,900				7,040,820
Total North Dakota		10,247,000		12,057,000		19,237,000		22,223,000

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OHIO

Cement	376-pound barrels	11, 872, 278	$29, 498, 956	11, 377, 806	$28, 488, 500	12, 532, 437	$32, 957, 308	13, 076, 921	$35, 929, 163
Clays		5, 686, 630	13, 764, 057	5, 493, 830	13, 643, 742	5, 634, 596	9, 327, 706	5, 051, 478	11, 136, 478
Coal		37, 948, 692	146. 677, 710	36, 208, 450	138, 090, 700	34, 736, 773	131, 475, 408	32. 468, 728	117, 519, 936
Lime (open-market)		2, 289, 473	29, 046, 196	2, 205, 432	28, 393, 260	2, 945, 800	35, 310, 353	2, 549, 046	31, 444, 083
Natural gas (marketed production)	million cubic feet	38, 879	7, 854, 000	30, 993	6, 725, 000	37, 542	8, 334, 000	28, 824	6, 111, 000
Natural-gas liquids:									
Natural gasoline	thousand gallons	4, 494	399, 000	1, 596	114, 000	(3)	(3)	(3)	(3)
Peat		21, 378	261, 891	24, 828	290, 664	27, 696	260, 474	29, 540	356, 970
Petroleum (crude)	thousand 42-gallon barrels	3, 140	9, 580, 000	3, 350	10, 020, 000	3, 610	9, 710, 000	[4] 3, 880	[4] 10, 710, 000
Salt (common)		3, 112. 472	5, 848, 478	2, 827, 455	5, 991, 626	3, 040, 237	7, 484, 795	2, 748, 993	12, 358, 521
Sand and gravel		19, 430, 898	21, 394, 891	20, 751, 493	23, 069, 458	24, 032, 388	27, 076, 276	25, 827, 220	27, 873, 469
Stone (except limestone for cement and lime, 1951–53)		[5] 25, 190, 277	[5] 36, 436, 081	[5] 24, 693, 189	[5] 36, 197, 485	[5] [6] 25,285,782	[5] [6] 39, 041, 308	32, 626, 737	47, 802, 169
Undistributed: Abrasive stones, bromine (1951), calcium-magnesium chloride, gypsum, ground sand and sandstone (1951–53), stone (crushed unclassified, 1951–52, dimension unclassified, 1952–53), recovered elemental sulfur, and minerals whose value should be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)			1, 850, 746		1, 664, 191		1, 264, 540		2, 084, 098
Total Ohio			302, 612, 000		292, 689, 000		302, 242, 000		[6] 293, 659, 000

OKLAHOMA

Clays		551, 200	$561, 841	520, 050	$577, 420	577, 557	$637, 082	452, 050	$1, 282, 848
Coal		2, 223, 229	13, 873, 424	2, 193, 409	12, 687, 855	2, 167, 594	13, 226, 881	1, 914, 834	11, 264, 692
Lead (recoverable content of ores, etc.)		16, 575	5, 734, 950	15, 137	4, 874, 114	9, 304	2, 437, 648	14, 204	3, 891, 896
Natural gas (marketed production)	million cubic feet	538, 756	28, 554, 000	554, 033	29, 918, 000	599, 955	41, 397, 000	616, 355	43, 145, 000
Natural-gas liquids:									
Natural gasoline and cycle products	thousand gallons	397, 236	27, 498, 000	405, 720	29, 459, 000	433, 650	28, 066, 000	478, 590	24, 332, 000
LP-gases	do	339, 528	12, 436, 000	376, 026	14, 090, 000	414, 036	14, 886, 000	453, 810	13, 506, 000
Petroleum (crude)	thousand 42-gallon barrels	186, 869	480, 250, 000	190, 435	487, 510, 000	202, 570	546, 940, 000	[4] 185, 851	[4] 518, 520, 000
Sand and gravel		3, 183, 251	2, 321, 653	3, 769, 663	2, 911, 845	[5] 5, 011, 366	[5] 4, 258, 585	5, 424, 131	4, 265, 031
Stone (except limestone for cement and lime, 1951–53)		6, 966, 676	6, 917, 548	[5] 9, 636, 475	[5] 8, 974, 334	[5] 8, 489, 994	[5] 7, 930, 737	[4] 9, 238, 811	[4] 9, 146, 995
Zinc (recoverable content of ores, etc.)		53, 450	19, 455, 800	54, 916	18, 232, 112	33, 413	7, 684, 990	43, 171	9, 324, 936
Undistributed: Native asphalt, cement, gypsum, lime, pumice and pumicite (1952–54), salt, ground sand and sandstone (1951–53), stone (dimension limestone, 1952 and 1954), recovered elemental sulfur (1953–54), and tripoli (1953–54). Excludes value of clays used for cement (1951–53)			9, 882, 690		12, 116, 791		[5] 11, 538, 234		12, 584, 340
Total Oklahoma			607, 486, 000		621, 351, 000		[5] 679, 003, 000		[6] 650, 205, 000

For footnotes, see end of table.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]—Continued

OREGON

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Chromite—gross weight	754	$62,972	6,591	$507,981	6,216	$484,453	(2)	(2)
Clays	151,920	162,242	277,072	569,968	292,445	296,050	(2)	(2)
Coal			1,179	8,650				
Copper (recoverable content of ores, etc.)	11	5,324	1	484	9	5,166	5	$2,950
Gold (recoverable content of ores, etc.)—troy ounces	7,927	277,445	5,509	192,815	8,488	297,080	6,520	228,200
Lead (recoverable content of ores, etc.)	2	692	1	322	5	1,310	5	1,370
Manganese ore (35 percent or more Mn)—gross weight					46	(2)		
Manganiferous ore (5 to 35 percent or more Mn)—do					271	(2)		
Mercury—76-pound flasks	1,177	247,323	868	172,819	648	125,083	489	129,287
Nickel ore							1,993	(2)
Pumice and pumicite	47,026	137,136	59,578	201,809	73,080	173,822	67,852	177,515
Sand and gravel	10,504,339	9,117,343	12,219,486	8,556,218	8,763,078	8,629,632	13,157,239	14,149,380
Silver (recoverable content of ores, etc.)—troy ounces	6,218	5,628	4,037	3,654	12,259	11,095	14,335	12,974
Stone (except limestone for cement and lime, 1951–53)	8,721,799	10,831,483	6,250,849	8,893,368	4,939,080	6,301,639	5,872,353	8,617,795
Tungsten concentrate—60-percent WO_3 basis	1	2,795	4	15,960	(19)	(2)	(19)	(2)
Zinc (recoverable content of ores, etc.)	3	1,092	1	332				
Undistributed: Asbestos (1951), carbon dioxide, cement, diatomite, gem stones, iron oxide pigments (1954), lime (1951–52), perlite (1951–53), quartz (1951–53), stone (crushed granite, 1953), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		7,550,554		7,549,366		8,123,493		10,172,067
Total Oregon		28,402,000		26,674,000		24,449,000		32,268,000

PENNSYLVANIA

Cement—376-pound barrels	41,560,431	$107,035,506	40,037,761	$103,388,586	42,093,765	$114,002,846	43,068,234	$117,912,299
Clays	4,230,567	14,087,550	3,731,130	12,639,864	3,575,287	9,987,928	3,524,398	10,243,485
Coal:								
Anthracite	42,669,997	405,817,963	40,582,558	379,714,076	30,949,152	299,139,687	29,083,477	247,870,023
Bituminous	108,163,843	572,194,085	89,181,232	473,475,646	93,330,871	516,490,411	72,010,101	378,658,531
Cobalt (content of ore)—pounds	755,631	(2)	639,856	(2)	564,450	(2)	517,124	(2)
Copper (recoverable content of ores, etc.)	5,297	2,563,748	3,485	1,686,740	3,027	1,737,498	(2)	(2)
Gold (recoverable content of ores, etc.)—troy ounces	2,179	76,265	1,500	52,500	1,134	39,690	1,317	46,095
Iron ore (usable)—long tons, gross weight	1,215,033	(2)	992,110	(2)	1,020,826	(2)	708,109	(2)

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Lime (open-market)	1,181,100	14,260,054	1,202,981	13,842,213	1,335,300	16,010,114	1,081,583	13,206,310
Natural gas (marketed production)—million cubic feet	128,715	35,654,000	108,684	30,758,000	105,558	30,717,000	145,934	43,634,000
Natural-gas liquids:								
Natural gasoline—thousand gallons	8,064	656,000	7,182	548,000	(3)	(3)	4,830	320,000
LP-gases—do	756	71,000	798	75,000	1,008	90,000	1,008	89,000
Peat	8,591	46,568	7,898	43,874	8,232	47,516	15,621	141,352
Petroleum (crude)—thousand 42-gallon barrels	11,345	48,220,000	11,233	47,740,000	10,649	45,680,000	[4] 9,107	[4] 31,150,000
Sand and gravel	15,737,464	21,488,540	14,696,106	19,920,003	14,715,383	20,692,391	14,218,444	20,595,990
Sericite schist					2,463	[7] 4,926	1,898	8,541
Silver (recoverable content of ores, etc.)—troy ounces	13,575	12,286	9,247	8,369	6,972	6,310	8,415	7,616
Slate	268,830	5,688,870	214,860	4,487,648	202,386	4,419,612	914,205	4,419,439
Stone (except limestone for cement and lime, 1951–53)	[5] 27,399,564	[5] 46,668,590	[5] 25,609,812	[5] 44,676,456	[5] 26,192,607	[5] 48,094,029	40,521,756	61,193,419
Undistributed: Graphite (crystalline, 1953), mica, pyrites, ground sand and sandstone (1951–53), stone (dimension unclassified, 1951; dimension basalt, 1952-53), recovered elemental sulfur (1952–54), tripoli, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		14,685,221		12,575,843		14,461,911		12,548,574
Total Pennsylvania		1,289,226,000		1,145,633,000		1,121,622,000		[6] 925,545,000
RHODE ISLAND								
Sand and gravel	534,785	$576,781	589,451	$557,396	898,393	$775,700	1,013,014	$979,470
Stone	239,248	651,931	168,993	654,782	161,632	617,096	(3)	(3)
Undistributed: Nonmetallic minerals and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		48,945		37,500		69,000		481,186
Total Rhode Island		1,278,000		1,250,000		1,462,000		1,461,000
SOUTH CAROLINA								
Clays	949,270	$4,736,276	947,278	$4,675,261	964,356	$4,801,921	1,136,019	$4,702,027
Sand and gravel	320,195	139,258	1,048,099	892,312	2,975,608	2,564,484	2,813,750	2,550,260
Stone	[5] 2,828,868	[5] 3,690,114	[5] 2,914,839	[5] 3,881,178	[5] 2,913,860	[5] 3,976,370	[5] 2,861,953	[5] 4,233,270
Undistributed: Barite, cement, kyanite, mica (1954), stone (dimension granite), and vermiculite. Excludes value of clays used for cement (1951–53)		2,878,338		5,236,961		6,428,135		6,373,880
Total South Carolina		11,444,000		14,686,000		17,771,000		[12] 17,744,000

For footnotes, see end of table.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]—Continued

SOUTH DAKOTA

Mineral		1951		1952		1953		1954	
		Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Beryllium concentrate	gross weight	138	$46,007	334	$166,251	392	$157,656	337	$139,663
Clays		381,611	3,061,988	292,791	2,640,640	330,983	2,826,074	(2)	(2)
Coal (lignite)		28,350	99,008			23,671	82,117	(2)	(2)
Columbium-tantalum concentrate	pounds, gross weight	(2)	(2)	(2)	(2)	4,431	9,022	25,447	43,260
Feldspar	long tons	45,559	290,520	40,163	220,954	50,601	321,026	(2)	(2)
Gold (recoverable content of ores, etc.)	troy ounces	458,101	16,033,535	482,534	16,888,690	534,987	18,724,545	541,445	18,950,575
Iron ore (usable)	long tons, gross weight					1,060	(2)		
Lead (recoverable content of ores, etc.)		2	692	2	644	10	2,620		
Mica:									
Scrap		2,292	42,714	915	24,148	1,687	27,388	1,510	26,943
Sheet	pounds			4,308	32,034	11,174	77,352	9,661	65,222
Natural gas (marketed production)	million cubic feet	7	350	6	300	5	[r] 250	7	[r] 350
Sand and gravel		5,037,384	2,502,340	5,846,140	2,478,314	5,402,378	[3] 2,817,726	19,110,358	7,840,393
Silver (recoverable content of ores, etc.)	troy ounces	139,590	126,336	132,102	119,559	138,642	125,478	151,407	137,031
Stone (except limestone for cement and lime, 1951–53)		1,263,322	4,660,074	1,671,187	4,806,882	[3] 1,189,444	[3] 4,997,497	1,614,818	4,928,855
Tungsten concentrate	60-percent WO_3 basis			(10)	335	2	(2)	(10)	500
Undistributed: Cement, gem stones (1953) gypsum (1954), lime, lithium minerals, petroleum (1954), stone (dimension miscellaneous 1953), vanadium (1954), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)			2,788,356		3,076,258		[3] 3,654,587		6,121,898
Total South Dakota			29,652,000		30,455,000		[3] 33,823,000		[3] 37,859,000

TENNESSEE

Cement	376-pound barrels	7,162,841	$17,203,080	7,428,604	$17,834,060	7,276,964	$18,283,366	7,569,279	$19,734,262
Clays		1,160,571	3,296,495	1,042,239	3,519,143	1,037,450	3,478,622	1,015,256	3,780,952
Coal		5,400,946	26,956,174	5,264,954	25,559,740	5,466,569	25,151,682	6,428,831	25,477,006
Copper (recoverable content of ores, etc.)		7,069	3,421,396	7,620	3,688,080	7,829	4,493,846	9,087	5,361,861
Fluorspar		140	(2)	348	(2)	426	(2)		
Gold (recoverable content of ores, etc.)	troy ounces	108	3,780	241	8,435	293	10,255	218	7,630
Iron ore (usable)	long tons, gross weight	35,908	142,447	(2)	(2)	12,751	82,499	(2)	(2)
Lead (recoverable content of ores, etc.)		14	4,844	18	5,796	9	2,358		
Lime (open-market)		108,970	1,097,874	100,189	1,005,235	114,474	1,177,461	80,372	968,078
Manganese ore (35 percent or more Mn)	gross weight			126	(2)	2,625	201,898	11,823	919,949
Natural gas (marketed production)	million cubic feet	132	12,000	107	11,000	89	11,000	89	10,000
Petroleum (crude)	thousand 42-gallon barrels	14	(2)	15	(2)	16	(2)	(2)	(2)
Phosphate rock [14]	long tons	1,424,516	10,798,406	1,444,737	11,306,438	1,518,912	11,305,098	1,633,226	11,743,012

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Sand and gravel	4,645,041	5,186,617	5,173,401	5,303,321	5,231,329	5,629,687	5,155,185	6,141,139
Silver (recoverable content of ores, etc.) troy ounces	24,960	22,590	57,569	52,103	68,935	62,390	60,795	54,990
Stone (except limestone for cement and lime, 1951–53)	[8] 8,838,796	[8] 14,765,988	10,377,320	17,652,763	[8] 10,485,351	[8] 16,948,053	14,040,187	22,046,016
Zinc (recoverable content of ores, etc.)	38,639	14,064,596	38,020	12,622,640	38,465	8,846,950	30,326	6,550,345
Undistributed: Barite, manganiferous ore (1954), pyrites, stone (dimension sandstone, 1951 and crushed granite, 1953) and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		3,070,648		2,363,399		2,364,412		5,479,598
Total Tennessee		100,047,000		100,932,000		98,050,000		[6] 105,686,000

TEXAS

Abrasive stone: Pebbles, grinding	350	$4,710	510	$3,100	400	$5,500	(3)	(3)
Cement 376-pound barrels	17,642,654	42,648,536	19,849,455	48,042,901	19,140,193	48,497,762	21,928,170	$56,674,124
Clays	2,217,053	4,944,965	2,069,020	4,470,182	2,370,975	4,678,974	2,400,924	7,002,024
Coal (lignite)							(3)	(3)
Copper (recoverable content of ores, etc.)	1	483	18	8,712				
Feldspar long tons	(3)	(3)	2,600	31,200			(3)	(3)
Gold (recoverable content of ores, etc.) troy ounces	32	1,120	39	1,365				
Gypsum	1,136,824	2,987,890	1,021,161	2,682,019	1,067,854	2,860,633	1,218,048	3,773,230
Helium cubic feet	82,690,000	1,060,000	107,301,332	1,405,096	103,711,334	1,388,671	110,588,471	1,873,860
Iron ore (usable) long tons, gross weight	1,053,131	(3)	787,193	(3)	1,014,937	(3)	881,190	(3)
Lead (recoverable content of ores, etc.)	43	14,878	56	18,032				
Lime (open-market)	279,957	2,532,387	281,604	2,622,975	475,569	4,380,831	547,436	5,421,732
Manganese ore (35 percent or more Mn) gross weight			56	(3)				
Natural gas (marketed production) million cubic feet	3,781,136	204,181,000	4,147,805	257,164,000	4,383,158	333,120,000	4,551,232	386,855,000
Natural-gas liquids:								
Natural gasoline and cycle products thousand gallons	2,516,094	189,973,000	2,589,594	188,500,000	2,750,370	200,479,000	2,732,100	200,559,000
LP-gases do	2,042,208	71,943,000	2,456,874	88,635,000	2,777,880	109,131,000	2,983,962	95,913,000
Peat	1,238	10,750	1,200	12,000	1,375	(3)	(3)	(3)
Petroleum (crude) thousand 42-gallon barrels	1,010,270	2,610,790,000	1,022,139	2,641,860,000	1,019,164	2,777,900,000	[4] 974,275	[4] 2,768,490,000
Salt (common)	2,401,063	4,000,100	2,640,209	4,402,032	2,845,190	5,010,624	2,864,312	9,310,339
Sand and gravel	18,488,463	15,651,531	18,661,403	17,275,255	15,101,226	12,845,561	26,315,635	24,840,811
Silver (recoverable content of ores, etc.) troy ounces	1,381	1,250	4,672	4,228			100	90
Stone (except limestone for cement and lime, 1951–53)	[8] 7,351,069	[8] 7,626,122	7,604,468	8,664,633	[8] 9,095,109	[8] 8,550,320	24,981,897	28,485,243
Sulfur (Frasch-process) long tons	3,835,280	81,900,000	3,691,724	78,910,000	3,614,838	97,601,000	3,474,477	92,791,821
Sulfur, recovered elemental do	(3)	(3)	38,344	872,134	84,717	2,202,381	107,232	2,889,100
Talc and soapstone	(3)	(3)	[10] 17,800	[10] 216,569	[11] 16,210	[11] 70,658	[11] 19,362	[11] 127,855
Zinc (recoverable content of ores, etc.)	24	8,736	3	996				
Undistributed: Native asphalt, bromine, gem stones, graphite (1951–53), magnesium chloride (for metal), magnesium compounds (except for metal), mercury (1951 and 1953), pumice and pumicite, sodium sulfate, stone (crushed basalt, 1951, and 1953; dimension granite, 1951; dimension sandstone, 1954), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3.) Excludes value of clays used for cement (1951–53)		28,918,581		34,010,619		39,189,833		52,083,713
Total Texas		3,269,199,000		3,379,813,000		[8] 3,647,913,000		[6] 3,730,162,000

For footnotes, see end of table.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]—Continued

UTAH

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Asphalt and related bitumens, native: Gilsonite	65,521	$1,895,374	60,740	$1,779,815	60,505	$2,184,328	75,943	$2,724,023
Carbon dioxide, natural (estimated)—thousand cubic feet	97,436	10,000	84,500	10,000	(2)	(2)	(2)	(2)
Clays	293,688	1,277,763	189,723	1,125,299	188,348	1,447,515	(2)	(2)
Coal	6,135,957	32,652,543	6,140,305	32,410,303	6,544,145	37,689,144	5,007,952	29,761,341
Copper (recoverable content of ores, etc.)	271,086	131,205,624	282,894	136,920,696	269,496	154,690,704	211,835	124,982,650
Fluorspar	17,827	398,480	17,304	438,699	15,527	374,944	4,403	82,358
Gold (recoverable content of ores, etc.)—troy ounces	432,216	15,127,560	435,507	15,242,745	483,430	16,920,050	403,401	14,119,035
Iron ore (usable)—long tons, gross weight	4,637,239	10,141,653	3,990,505	15,025,899	4,617,288	26,496,950	3,040,646	19,277,434
Lead (recoverable content of ores, etc.)	50,451	17,456,046	50,210	16,167,620	41,522	10,878,764	44,972	12,322,328
Lime (open-market)	(2)	(2)	(2)	(2)	(2)	(2)	30,428	431,828
Manganese ore (35 percent or more Mn)—gross weight			95	(2)	550	(2)	25	(2)
Manganiferous ore (5 to 35 percent Mn)—do	1,369	(2)	3,397	(2)	5,155	82,316	97	(2)
Natural gas (marketed production)—million cubic feet	3,733	246,000	3,006	225,000	7,075	807,000	16,024	2,259,000
Perlite	3,422	16,017	(2)	(2)	(2)	(2)	(2)	(2)
Petroleum (crude)—thousand 42-gallon barrels	1,305	(2)	1,737	(2)	1,807	(2)	[4] 1,905	4,480,000
Pumice and pumicite	9,422	11,478	(2)	(2)	3,880	4,385	3,588	3,788
Salt (common)	131,444	570,379	136,125	522,721	154,088	772,035	166,506	1,020,061
Sand and gravel	2,971,268	2,268,750	3,260,044	2,350,412	4,627,808	3,179,690	5,327,969	3,592,286
Silver (recoverable content of ores, etc.)—troy ounces	7,310,665	6,616,521	7,194,109	6,511,032	6,725,807	6,087,195	6,179,243	5,592,527
Stone (except limestone for cement and lime, 1951–53)	1,226,710	1,291,118	[5] 852,351	[6] 1,123,108	997,330	1,446,594	1,127,461	1,545,841
Tungsten concentrate—60-percent WO_3 basis	(10)	565	3	9,449	35	123,445	84	308,634
Vanadium—pounds	551,949	(2)	277,367	(2)	1,058,345	(2)	1,077,806	(2)
Zinc (recoverable content of ores, etc.)	34,317	12,491,388	32,947	10,938,404	29,184	6,712,320	34,031	7,350,696
Undistributed: Native asphalt (bituminous sandstone, 1951), cement, gypsum, molybdenum, natural gasoline, phosphate rock (1951, 1953–54), potassium salts, stone (crushed marble, 1952), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		23,467,351		24,699,578		[7] 28,732,045		25,942,747
Total Utah		257,145,000		265,501,000		298,629,000		[11] 255,234,000

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VERMONT

Copper (recoverable content of ores, etc.)	3,774	$1,826,616	3,774	$1,826,616	3,947	$2,265,578	4,352	$2,567,680
Gold (recoverable content of ores, etc.)—troy ounces	156	5,460	162	5,670	171	5,985	185	6,475
Lime (open-market)	32,179	432,483	(3)	(3)	(3)	(3)	(3)	(3)
Pyrites—long tons			17,892	(3)	19,486	(3)	20,713	(3)
Sand and gravel	965,702	646,702	1,264,490	749,835	1,113,607	690,073	1,481,549	1,110,996
Silver (recoverable content of ores, etc.)—troy ounces	41,300	37,379	45,361	41,054	43,128	39,033	48,572	43,960
Stone (except limestone for lime, 1951–53)	450,980	7,253,824	404,391	6,016,530	527,150	8,859,703	436,870	8,178,389
Talc	[10] 78,694	[10] 998,792	[10] 71,027	[10] 926,646	[11] 80,209	[11] 240,627	[11] 66,195	[11] 198,585
Undistributed: Asbestos, clays, slate, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		7,315,198		8,324,329		8,201,333		[12] 8,377,342
Total Vermont		18,516,000		17,891,000		20,302,000		20,483,000

VIRGINIA

Beryllium concentrate—gross weight							(19)	$39
Clays	775,245	$825,097	940,496	$996,351	952,266	$927,571	704,843	723,292
Coal	21,399,869	115,978,072	21,579,368	114,861,137	19,119,050	102,022,118	16,387,292	72,901,277
Feldspar—long tons	30,979	232,099	(3)	(3)	(3)	(3)	(3)	(3)
Iron ore (usable)—long tons, gross weight	7,248	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Lead (recoverable content of ores, etc.)	1,508	521,768	3,792	1,221,024	[5] 2,788	[5] 730,456	4,320	1,183,680
Lime (open-market)	452,680	4,551,656	442,845	4,448,924	477,384	4,947,418	445,158	4,610,645
Manganese ore (35 percent or more Mn)—gross weight			1,011	(3)	8,454	635,926	22,678	1,780,934
Marl, calcareous (except for cement)	(3)	(3)	(3)	(3)	(3)	(3)	33,174	21.079
Natural gas (marketed production)—million cubic feet	64	10,000	1,133	279,000	3,697	954,000	1,401	380,000
Petroleum (crude)—thousand 42-gallon barrels	12	(3)	10	(3)	8	(3)	[4] 7	(3)
Sand and gravel	5,772,781	5,750,409	7,136,112	5,556,953	5,276,350	5,160,564	7,115,403	8,657,871
Silver (recoverable content of ores, etc.)—troy ounces					1,169	1,058	1,773	1,605
Slate	(3)	(3)	(3)	(3)	(3)	(3)	17,410	68,911
Stone (except limestone for cement and lime, 1951–53)	9,277,252	16,621,116	9,670,961	16,969,952	9,091,907	16,258,620	10,893,972	18,137,501
Zinc (recoverable content of ores, etc.)	7,332	2,668,848	13,409	4,451,788	16,676	3,835,480	16,738	3,615,408
Undistributed: Beryllium concentrate (1954), aplite, cement, gypsum, kyanite, iron oxide pigments (1954), mica, pyrites, salt ground sand and sandstone (1951–53), talc and soapstone, titanium concentrate, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		14,093,092		15,893,790		17,505,609		19,403,489
Total Virginia		161,252,000		164,679,000		[5] 152,979,000		[6] 129,603,000

For footnotes, see end of table.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]—Continued

WASHINGTON

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Abrasive stone:								
Pebbles (grinding)	28	$336	20	$240	(3)	(3)	(3)	(3)
Pulpstones	22	1,970	12	908				
Antimony ore and concentrate—gross weight	110	(3)	100	(3)				
Clays	286,364	366,808	291,134	352,576	259,421	$312,141	261,328	$318,500
Coal	857,026	6,031,400	844,197	5,986,129	689,831	5,047,928	619,209	4,478,127
Copper (recoverable content of ores, etc.)	4,089	1,979,076	4,357	2,108,788	3,740	2,146,760	3,626	2,145,240
Epsomite			(3)	(3)	200	8,000	(3)	(3)
Gold (recoverable content of ores, etc.)—troy ounces	67,405	2,359,175	54,776	1,917,160	62,560	2,189,600	66,740	2,335,900
Gypsum	(3)	(3)	7,900	29,625	3,800	14,250	(3)	(3)
Lead (recoverable content of ores, etc.)	8,002	2,768,692	11,744	3,781,568	11,064	2,898,768	9,938	2,723,012
Manganese ore (35 percent or more Mn)—gross weight			436	(3)	(3)	(3)		
Manganiferous ore (5 to 35 percent Mn)—do			142	(3)				
Peat	45,304	98,955	42,580	111,386	32,107	104,274	43,134	153,058
Pumice and pumicite	5,105	10,832	3,604	8,089	(3)	(3)	(3)	(3)
Sand and gravel	10,546,949	7,595,837	13,322,279	9,422,117	11,182,835	9,317,793	16,044,687	13,595,014
Silver (recoverable content of ores, etc.)—troy ounces	334,948	303,145	315,645	285,675	321,202	290,704	313,735	283,946
Stone (except limestone for cement and lime, 1951–53)	5,029,735	5,664,433	4,523,234	5,491,525	4,438,259	5,890,849	5,366,890	9,526,534
Talc and soapstone	(3)	(3)	(3)	(3)	5,351	28,833	(3)	(3)
Tungsten concentrate—60-percent WO_3 basis	9	33,417	4	14,008	5	19,710	18	65,812
Zinc (recoverable content of ores, etc.)	18,189	6,620,796	20,102	6,673,864	32,786	7,540,780	22,304	4,817,664
Undistributed: Barite (1953), carbon dioxide, cement, diatomite (1952–54), gem stones, lime, magnesite, olivine quartz, ground sand and sandstone (1951–53), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement		20,719,457		19,955,089		18,766,830		16,923,833
Total Washington		54,554,000		56,139,000		54,577,000		[6] 53,300,000

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WEST VIRGINIA

Clays	1,103,646	$2,295,026	982,030	$2,421,669	968,838	$2,488,938	587,120	$1,450,539
Coal	163,309,822	853,893,679	141,713,059	741,421,131	134,105,310	693,593,645	115,996,041	541,369,652
Natural gas (marketed production) million cubic feet	191,146	35,553,000	180,995	35,475,000	186,477	44,009,000	191,601	45,601,000
Natural-gas liquids:								
Natural gasoline thousand gallons	46,494	3,337,000	43,302	3,069,000	44,352	3,245,000	41,076	2,593,000
LP-gases do	161,448	5,568,000	199,794	6,187,000	153,090	6,743,000	142,884	5,035,000
Petroleum (crude) thousand 42-gallon barrels	2,757	10,370,000	2,602	9,780,000	3,038	11,570,000	[4] 2,902	[4] 8,500,000
Salt (common)	379,299	1,314,818	392,519	1,438,490	419,907	1,490,592	471,516	2,885,696
Sand and gravel	4,735,271	8,314,195	4,120,105	7,275,370	3,162,776	6,070,847	4,073,991	8,351,153
Stone (except limestone for cement and lime, 1951–53)	[5] 5,754,378	[5] 8,472,639	[5] 4,869,442	[5] 6,826,113	[5] 5,501,148	[5] 8,924,411	7,314,934	11,743,440
Undistributed: Abrasive stones (1951–53), bromine, calcium-magnesium chloride, cement, lime, calcareous marl, ground sand and sandstone (1951–53), stone (dimension limestone 1951–53), and recovered elemental sulfur. Excludes value of clays used for cement (1951–53)		12,629,965		11,838,988		11,974,948		10,504,113
Total West Virginia		941,748,000		825,733,000		790,110,000		[6] 636,311,000

WISCONSIN

Abrasive stone: Pebbles (grinding)	1,327	$26,540	723	$17,352	(3)	(3)	(3)	(3)
Clays	141,746	141,746	134,453	134,493	175,311	$175,276	180,233	$174,488
Iron ore (usable) long tons, gross weight	1,745,120	(3)	1,485,845	(3)	1,655,331	(3)	1,428,910	(3)
Lead (recoverable content of ores, etc.)	1,391	481,286	2,000	644,000	2,094	548,628	1,261	345,514
Lime (open-market)	124,852	1,562,200	107,813	1,368,556	123,997	1,566,085	115,397	1,557,579
Marl, calcareous (except for cement)	20,625	12,925	17,000	8,833	15,871	7,327	19,607	9,817
Peat	(3)	(3)	(3)	(3)	366	(3)	(3)	(3)
Sand and gravel	19,391,772	12,392,464	24,895,947	16,938,228	[5] 23,664,086	[5] 16,253,302	23,978,722	17,396,438
Stone (except limestone for cement and lime, 1951–53)	7,609,323	14,671,858	8,578,882	16,754,675	7,450,396	15,979,756	8,289,373	16,187,738
Zinc (recoverable content of ores, etc.)	15,754	5,734,456	20,588	6,835,216	16,830	3,870,900	15,534	3,355,344
Undistributed: Abrasive stone (tube-mill liners), cement, quartz (1951–53), ground sand and sandstone (1951–53), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement (1951–53)		13,326,715		13,008,759		[5] 16,810,752		15,839,813
Total Wisconsin		48,350,000		55,710,000		[5] 55,212,000		[6] 54,286,000

For footnotes, see end of table.

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TABLE 5.—Mineral production in the United States, 1951–54, by States [1]—Continued

WYOMING

Mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	483,050	$5,999,451	706,748	$9,176,507	852,651	$10,036,727	943,505	$9,534,087
Coal	6,429,633	26,937,896	6,088,421	26,451,530	5,244,572	23,743,996	2,831,430	11,541,312
Copper (recoverable content of ores, etc.)					1	574	1	590
Gold (recoverable content of ores, etc.)—troy ounces	9	315	1	35	1	35	407	14,245
Gypsum	(2)	(3)	(3)	(3)	5,493	21,972	7,403	29,612
Iron ore (usable)—long tons, gross weight	616,949	(3)	484,945	(3)	654,285	(3)	458,237	(3)
Natural gas (marketed production)—million cubic feet	71,508	5,363,000	75,313	5,874,000	76,262	6,025,000	71,068	5,970,000
Natural-gas liquids:								
Natural gasoline—thousand gallons	49,392	3,511,000	51,492	4,016,000	(2)	(3)	47,082	3,137,000
LP-gases—do	32,928	1,634,000	38,976	1,881,000	(2)	(3)	46,084	2,128,000
Petroleum (crude)—thousand 42-gallon barrels	68,929	148,200,000	68,074	148,400,000	82,618	195,800,000	[4] 93,533	[4] 229,160,000
Phosphate rock [14]—long tons	166,156	1,088,822	186,715	1,247,256	(2)	(3)	(2)	(2)
Pumice	1,867	9,141	2,851	10,918	648	1,898	(3)	(3)
Sand and gravel	2,347,078	1,730,900	2,426,999	1,738,548	3,149,376	2,001,197	4,103,660	2,681,527
Silver (recoverable content of ores, etc.)—troy ounces	2	2			11	10	74	67
Stone (except limestone for cement, 1951–53)	1,645,475	1,857,267	1,466,567	1,688,890	1,431,372	1,839,922	1,616,015	1,665,302
Sulfur, recovered elemental—long tons	(2)	(3)	(3)	(3)	(2)	(3)	113,101	2,977,954
Vermiculite	(3)	(3)	(3)	(3)	403	2,418		
Undistributed: Cement, feldspar (1953), gem stones, manganiferous ores (1953), sodium carbonate and sulfate, sulfur ore (1951–53), vanadium (1954), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement in 1953		8,025,379		6,343,624		16,432,721		12,826,704
Total Wyoming		204,357,000		206,828,000		255,906,000		[6] 281,306,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers). Excludes uranium and monazite.
[2] Excludes pozzolan cement, value for which is included with "Undistributed."
[3] Value included with "Undistributed."
[4] Final figure. Supersedes preliminary figure given in commodity chapter.
[5] Revised figure.
[6] Total adjusted to eliminate duplication in the value of clays and stone.
[7] Estimate.
[8] Excludes certain stone, value for which is included with "Undistributed."
[9] Weight not recorded.
[10] Sold or used by producers. Quantity and value of ground material included.
[11] Mine production of crude material.
[12] Beginning with 1954 quartz from pegmatites and quartzite included with stone.
[13] Total has been adjusted to eliminate duplication in the value of raw materials used in the manufacture of cement and/or lime.
[14] Basis for reporting phosphate rock has been changed from shipments to marketable production, because the latter more nearly reflects output at the mine on a calendar year basis.
[15] Beginning with 1954 sand and sandstone (ground) included with sand and gravel or stone.
[16] Includes value of nonmetallic minerals; excludes value of clays used for cement.
[17] Excludes natural cement, value for which is included with "Undistributed."
[18] Recoverable zinc valued at the yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of ore at mine.
[19] Less than 1 ton.

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TABLE 6.—Mineral production in Territories of the United States, 1951–54, by individual minerals [1]

Territory and mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Alaska:								
Antimony ore and concentrate—gross weight	301	[2]	420	[2]				
Chromite—do							2,953	$208,257
Coal	494,333	$3,766,987	686,218	$5,779,423	861,471	$8,451,542	666,618	6,442,414
Copper (recoverable content of ores, etc.)	[3] 1	387					4	2,360
Gold (recoverable content of ores, etc.)—troy ounces	239,637	8,387,295	240,557	8,419,495	253,783	8,882,405	248,511	8,697,885
Lead (recoverable content of ores, etc.)	[3] 21	7,266	1	386	9	2,240		
Mercury—76-pound flasks			28	5,575	40	7,721	1,046	276,552
Sand and gravel	6,887,646	3,738,516	10,781,926	8,650,582	7,689,278	5,079,681	6,639,638	6,301,939
Silver (recoverable content of ores, etc.)—troy ounces	32,870	29,749	32,968	29,854	35,387	32,027	33,697	30,497
Stone			[2]	[2]	47,086	169,711	283,734	465,423
Tin (content of ore and concentrate)—long tons	69	197,163	82	220,956	49	105,917	199	409,953
Tungsten concentrate—60-percent WO_3 basis	10	[2]	8	[2]	3	[2]		
Zinc (recoverable content of ores, etc.)	[3] 1	218						
Undistributed: Clays (1954), gem stones (1952–53), platinum group metals, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2)		3,441,090		3,195,336		1,520,782		1,576,380
Total Alaska		19,569,000		26,302,000		24,252,000		24,412,000
Hawaii:								
Lime (open-market)	8,740	236,052	8,894	240,786	7,431	223,575	8,375	251,610
Sand and gravel	2,561	5,710	111,716	143,541	110,558	156,853	119,121	318,754
Stone	[4] 650,094	[4] 1,337,474	705,994	1,545,301	[4] 1,299,501	[4] 2,654,358	1,485,427	2,993,032
Undistributed: Other nonmetallic minerals		147,063		17,164		297,474		58,778
Total Hawaii		1,726,000		1,947,000		3,332,000		[5] 3,596,000
Total Territories		21,295,000		28,249,000		27,584,000		28,008,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Value included with "Undistributed."
[3] Produced in 1950, but not shipped until 1951 from a mine not active in 1951.
[4] Excludes certain stone value for which is included with "Undistributed."
[5] Total has been adjusted to eliminate duplication in the value of limestone used in lime.

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TABLE 7.—Mineral production in possessions of the United States, 1951–54, by individual minerals [1] [2]

Possession and mineral	1951		1952		1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
American Samoa:								
Sand and gravel					[3] 1,320	[3] $425	1,800	$675
Stone					[3] 74,750	[3] 16,500	57,600	15,000
Total American Samoa						[3] 17,000		16,000
Canal Zone:								
Sand and gravel	32,000	$26,000	56,600	$53,000	85,914	95,500		
Stone (crushed)	55,500	112,000	86,000	152,000	171,908	231,752	187,446	245,170
Total Canal Zone		138,000		205,000		327,000		245,000
Canton: Stone (crushed)	360	900	150	375	4,200	8,750	2,600	5,000
Guam: Stone	720,000	675,000	948,000	870,000	2,080,650	5,573,169	842,660	2,275,182
Johnston: Stone							98	300
Midway: Stone (crushed)	[4]	[4]	[3] 7,200	[3] 6,000	204	638	490	1,500
Puerto Rico:								
Cement—376-pound barrels	4,297,583	11,252,350	3,994,483	10,517,894	3,641,135	9,335,421	3,682,187	9,663,445
Iron ore (usable)—long tons	39,219	225,509	138,613	797,025	142,643	245,000		
Lime (open-market)	10,350	191,415	8,575	195,000	7,338	157,467	8,384	198,452
Salt (common)	10,566	119,338	12,676	122,158	13,692	131,490	8,758	98,110
Sand and gravel	99,628	99,657	122,730	164,166	226,586	250,202	374,690	833,654
Stone (except limestone for cement and lime, 1951–53)	283,697	613,751	[5] 689,320	[5] 1,807,388	[5] 648,400	[5] 1,237,236	[5] 1,751,996	[5] 2,492,827
Undistributed: Other nonmetallic minerals				6,328		44,466		154,331
Total Puerto Rico		12,502,000		13,610,000		11,401,000		[6] 12,381,000
Virgin Islands: Stone (crushed)	11,600	47,300	12,900	51,900	10,789	45,853	3,939	17,134
Wake: Stone (crushed)	240	600	4,260	8,000	11,980	20,615	780	1,300
Total		13,364,000		14,751,000		17,394,000		14,943,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Production data for Canton and Wake furnished by the U. S. Department of Commerce, Civil Aeronautics Administration; Midway and Johnston, by the U. S. Department of the Navy; Guam, by the Government of Guam, American Samoa, by the Government of American Samoa.
[3] Estimate.
[4] Data not available.
[5] Excludes certain stone value for which is included with "Undistributed."
[6] Total has been adjusted to eliminate duplication in the value of stone.

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TABLE 8.—Principal minerals imported for consumption in the United States, 1953–54

(Compiled by Mae B. Price and Elsie D. Page, Division of Foreign Activities, Bureau of Mines, from records of the U. S. Department of Commerce)

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value (thousand dollars)	Short tons (unless otherwise stated)	Value (thousand dollars)
METALLIC				
Aluminum:				
Metal	300,928	115,761	215,250	[1] 83,573
Scrap	26,621	8,072	14,845	[1] 4,675
Plates, sheets, bars, etc	31,932	18,637	13,655	[1] 8,402
Antimony:				
Ore (antimony content)	7,778	2,039	4,722	1,290
Needle or liquated	17	9	33	17
Metal	2,612	1,402	2,802	1,349
Oxide	1,296	580	1,476	645
Arsenic: White	4,717	574	4,848	545
Bauxite:				
Crude long tons	[2] 4,390,576	[2] 29,585	5,283,888	36,437
Calcined, when imported for manufacture of fire brick long tons	91,606	2,116	99,931	2,372
Beryllium ore	[2] 7,998	[2] 3,753	5,816	2,574
Bismuth pounds	641,428	1,273	628,833	1,235
Boron carbide do	72,526	122	24,209	50
Cadmium:				
Metal do	1,555,140	2,674	402,299	654
Flue dust (cadmium content) do	1,863,538	1,587	1,482,565	1,078
Calcium:				
Metal	990,017	1,010	685,417	728
Chloride	2,671	85	1,547	51
Chromite:				
Ore and concentrates (Cr_2O_3 content)	[2] 942,492	[2] 56,102	608,735	34,112
Ferrochrome (chromium content)	20,604	10,398	9,563	3,502
Metal	177	300	143	225
Cobalt:				
Alloy (cobalt content) pounds	2,412,804	[3]	2,360,360	[3]
Ore (do) do	51,323	88	3,349	6
Metal do	14,431,894	33,203	14,227,868	35,391
Oxide (gross weight) do	610,054	980	430,400	723
Salts and other compounds (gross weight) do	273,286	173	353,094	211
Columbium ore do	[2] 4,186,080	[2] 6,891	6,804,076	14,191
Copper (copper content):				
Ore	5,560	3,058	6,182	3,399
Concentrate	96,448	53,007	114,692	62,793
Regulus, black, coarse	6,547	4,041	5,408	3,089
Unrefined, black, blister	279,242	179,226	252,827	148,286
Refined in ingots, etc	[2] 274,111	182,190	215,178	127,138
Old and scrap	7,827	4,018	4,752	[1] 2,081
Old brass and clippings	7,503	3,737	3,657	[1] 1,568
Ferroalloys: Ferrosilicon	2,206	835	3,760	1,244
Gold:				
Ore and base bullion troy ounces	661,696	23,112	822,684	28,721
Bullion do	682,261	23,878	260,321	9,112
Iron ore:				
Ore long tons	11,074,035	[2] 96,788	15,777,824	[1] 119,330
Pyrites cinder do	12,053	54	898	4
Iron and steel:				
Pig iron	589,825	25,967	290,716	13,315
Iron and steel products (major):				
Semimanufactures	[2] 867,581	[2] 99,795	258,089	[1] 21,747
Manufactures	[2] 871,892	[2] 119,862	616,022	[1] 75,923
Scrap	[2] 131,568	[2] 4,755	206,316	[1] 5,116
Tinplate scrap	42,092	1,115	32,671	[1] 832
Lead:				
Ore, flue dust, matte (lead content)	67,030	15,214	196,054	[1] 47,967
Base bullion do	742	294	41	10
Pigs and bars do	379,119	95,285	274,286	[1] 68,420
Reclaimed, scrap, etc do	3,660	825	7,217	[1] 1,450
Sheets, pipe, and shot	178	58	397	[1] 129
Babbitt metal and solder (lead content)	1,343	1,869	1,572	[1] 1,946
Type metal and antimonial lead (lead content)	5,016	1,921	3,367	[1] 1,251
Manufactures	[3]	243	[3]	[1] 149
Magnesium:				
Metallic and scrap	2,443	877	733	338
Alloys (magnesium content)	3	16	6	30
Sheets, tubing, ribbons, wire and other forms (magnesium content)	5	20	8	14

For footnotes, see end of table.

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TABLE 8.—Principal minerals imported for consumption in the United States, 1953–54—Continued

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value (thousand dollars)	Short tons (unless otherwise stated)	Value (thousand dollars)
METALLIC—continued				
Manganese:				
Ore (35 percent or more manganese) (manganese content)	1,393,000	103,512	1,029,795	75,796
Ferromanganese (manganese content)	98,207	27,181	44,744	10,903
Spiegeleisen, less than 30 percent manganese, more than 1 percent carbon (manganese content)	785	63	----	----
Mercury:				
Compounds, pounds	29,891	78	35,008	[1] 93
Metal, flasks	83,393	13,569	64,957	[1] 10,784
Minor metals: Selenium and salts, pounds	[2] 102,165	457	209,596	1,154
Molybdenum: Ore and concentrate (molybdenum content), do	----	----	154,288	180
Nickel:				
Ore and matte, do	29,209,949	5,794	28,270,488	5,358
Pigs, ingots, shot, cathodes, do	[2]169,427,598	[2] 102,461	194,526,085	[1] 124,179
Scrap, do	1,730,580	289	888,591	[1] 276
Oxide, do	63,700,065	26,286	64,528,952	25,234
Platinum group:				
Unrefined materials:				
Ore and concentrate, troy ounces	[2] 840	[2] 50	2,714	191
Grain and nuggets, including crude, dust and residues, do	[2] 45,047	[2] 3,424	43,355	2,725
Sponge and scrap, do	[2] 824	70	4,230	[1] 367
Osmiridium, do	1,814	175	2,988	290
Refined metal:				
Platinum, do	340,632	29,325	339,490	[1] 26,500
Palladium, do	227,080	4,548	188,839	[1] 3,468
Iridium, do	1,643	252	432	55
Osmium, do	583	67	199	[1] 20
Rhodium, do	[2] 12,299	[2] 1,323	13,197	1,336
Ruthenium, do	[2] 3,326	[2] 213	6,168	333
Radium:				
Radium salts, milligrams	[2] 85,055	[2] 1,475	57,879	857
Radioactive substitutes	(3)	[2] 170	(3)	150
Rare earths: Ferrocerium and other cerium alloy, pounds	4,211	18	5,736	22
Silver:				
Ore and base bullion, troy ounces	37,685,219	31,950	49,008,443	40,404
Bullion, do	43,824,916	37,220	41,888,631	35,541
Tantalum: Ore, pounds	[2] 759,409	[2] 1,230	981,872	1,972
Tin:				
Ore (tin content), long tons	35,973	82,713	22,140	41,725
Blocks, pigs, grains, etc, do	[2] 74,570	[2] 175,950	65,552	133,186
Dross, skimmings, scrap, residues, and tin alloys, n. s. p. f., pounds	[2] 15,924,059	[2] 11,895	13,277,707	9,378
Tinfoil, powder, flitters, etc	(3)	606	(3)	[1] 785
Titanium:				
Ilmenite	286,644	5,464	275,005	[1] 4,993
Rutile	16,098	1,791	14,965	1,323
Metal, pounds	71,309	269	385,045	1,371
Ferrotitanium, do	344,337	115	10,000	4
Compounds and mixtures, do	180,035	24	10,500	7
Tungsten:				
Ore and concentrate (tungsten content), do	[2] 28,060,449	[2] 91,602	24,092,078	[1] 75,879
Metal (tungsten content), do	66,546	225	154,096	[1] 343
Ferrotungsten (tungsten content), do	603,299	1,687	500,204	837
Other (tungsten content), do	[2] 147,971	343	65,650	101
Vanadium:				
Ore (vanadium content), do	716,977	421	395,287	238
Flue dust (vanadium content), do	1,010	2	----	----
Ferrovanadium, do	17,364	13	----	----
Salts and compounds, do	3,090	2	4,000	3
Zinc:				
Ores (zinc content)	[2] 449,732	47,918	479,816	[1] 52,482
Blocks, pigs, and slabs	227,654	50,282	160,138	[1] 33,722
Sheets	196	77	259	88
Old, dross, and skimmings	5,915	557	1,087	103
Dust	1,045	162	----	----
Manufactures	(3)	6	(3)	[1] 41
Zirconium: Ore, including zirconium sand	24,667	572	18,657	[1] 487

For footnotes, see end of table.

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TABLE 8.—Principal minerals imported for consumption in the United States, 1953–54—Continued

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value (thousand dollars)	Short tons (unless otherwise stated)	Value (thousand dollars)
NONMETALLIC				
Abrasives: Diamonds (industrial)—carats	[2] 13,525,776	[2] 49,282	13,991,151	[1] 48,703
Asbestos	[2] 692,245	[2] 59,754	678,390	[1] 55,857
Barite:				
Crude and ground	335,047	2,523	317,345	[1] 2,284
Witherite	4,928	179	4,415	153
Chemicals	6,074	507	3,548	453
Bromine and compounds—pounds	575	41	77,649	121
Cement—376-pound barrels	386,051	1,266	450,248	[1] 1,763
Clay:				
Raw	146,851	2,142	163,157	[1] 2,445
Manufactured	2,260	53	1,543	40
Cryolite—long tons	26,301	3,528	18,876	2,216
Feldspar: Crude—do	5,901	61	79	3
Fluorspar	[2] 359,569	11,427	293,320	[1] 8,962
Gem stones:				
Diamonds—carats	[2] 1,174,712	[2] 107,573	1,482,045	122,187
Emeralds—do	42,513	349	24,460	385
Other	(3)	22,273	(3)	[1] 21,022
Graphite	51,323	2,809	40,839	[1] 2,281
Gypsum:				
Crude, ground, calcined	3,185,180	4,320	3,368,817	[1] 4,904
Manufactures	(3)	472	(3)	473
Iodine, crude—pounds	957,638	1,606	945,985	1,034
Jewel bearings—number	86,892,637	3,708	49,262,927	[1] 2,219
Kyanite	6,620	288	4,826	[1] 197
Lime:				
Hydrated	2,177	31	1,259	[1] 17
Other	31,149	507	30,613	538
Dead-burned dolomite	3,876	259	4,426	345
Magnesium:				
Magnesite	42,010	2,574	70,650	4,250
Compounds	7,551	318	10,092	[1] 308
Mica:				
Uncut sheet and punch—pounds	2,599,007	4,279	1,829,457	[1] 3,198
Scrap	3,927	72	4,647	[1] 63
Manufactures	5,763	[2] 10,910	3,363	[1] 5,449
Mineral-earth pigments:				
Iron oxide pigments:				
Natural	2,716	123	2,546	121
Synthetic	4,531	523	4,997	603
Ocher, crude and refined	177	9	154	9
Siennas, crude and refined	700	60	338	35
Umber, crude and refined	2,725	78	2,598	74
Vandyke brown	164	9	89	5
Nitrogen compounds (major)	2,189,725	105,724	1,913,200	[1] 89,321
Phosphate, crude—long tons	101,171	2,545	122,016	[1] 3,081
Phosphatic fertilizers—do	[2] 25,599	[2] 1,310	26,316	[1] 1,507
Pigments and salts:				
Lead pigments and salts	83	22	712	[1] 169
Zinc pigments and salts	1,464	316	3,178	[1] 582
Potash	[2] 250,557	[2] 9,953	225,230	8,387
Pumice:				
Crude or unmanufactured	32,712	166	20,951	117
Wholly or partly manufactured	943	20	950	[1] 21
Manufactures, n. s. p. f.	(3)	5	(3)	[1] 7
Quartz crystal (Brazilian pebble including all classes)—pounds	1,320,683	2,255	780,556	1,579
Salt	137,308	473	160,770	[1] 879
Sand and gravel:				
Glass sand	5,690	114	10,329	93
Other sand	313,176	330	271,364	[1] 298
Gravel	87,028	10	2,387	[1] 2
Sodium sulfate	61,198	1,082	118,512	2,141
Stone and whiting	(3)	5,073	(3)	[1] 5,216
Strontium: Mineral	6,897	124	3,291	53

For footnotes, see end of table.

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TABLE 8.—Principal minerals imported for consumption in the United States, 1953–54—Continued

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value (thousand dollars)	Short tons (unless otherwise stated)	Value (thousand dollars)
NONMETALLIC—continued				
Sulfur and pyrites:				
Sulfur:				
Ore, long tons	525	18	110	2
Other forms, n. e. s., do	704	33	1,104	[1] 56
Pyrites, do	190,474	664	[4] 46,649	[4] 292
Talc: Unmanufactured	22,803	717	22,157	[1] 678
FUELS				
Asphalt and related bitumen	2,699	71	4,244	102
Carbon black:				
Acetylene black, pounds	9,007,816	1,435	7,715,875	1,282
Gas black and carbon black, do	1,153,801	178	74,657	[1] 9
Coal:				
Anthracite	31,443	547	5,831	105
Bituminous, slack and culm, lignite	226,900	1,610	198,799	[1] 1,608
Briquets	97	1	239	2
Coke	157,318	1,715	115,781	[1] 1,258
Peat:				
Fertilizer grade	180,996	6,489	220,768	[1] 7,911
Poultry and stable grade	18,891	845	22,593	[1] 925
Petroleum:				
Crude, thousands of barrels	237,908	509,851	242,531	[1] 544,381
Gasoline [5], do	587	3,130	1,349	6,967
Kerosine, do	(6)	(6)	(6)	(6)
Distillate oil [7], do	4,005	11,054	4,258	13,062
Residual oil [8], do	134,824	225,876	132,283	240,225
Unfinished oil, do	2,922	6,391	8,257	17,107
Asphalt, do	2,550	5,364	3,420	6,610
Miscellaneous, do	1	57	4	100

[1] Due to changes in tabulating procedures by the U. S. Department of Commerce data known not to be comparable to earlier years.
[2] Revised figure.
[3] Data not available.
[4] In addition to data shown an estimated 232,920 long tons ($627,620) were imported.
[5] Includes naphtha but excludes benzol: 1953–490,000 barrels ($7,408,000); 1954—291,000 barrels ($3,968,000).
[6] Less than 1,000.
[7] Includes quantities imported free of duty for supplies of vessels and aircraft.
[8] Includes quantities imported free for manufacture in bond and export, and for supplies of vessels and aircraft.

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TABLE 9.—Principal minerals and products exported from the United States, 1953–54

(Compiled by Mae B. Price and Elsie D. Page, Division of Foreign Activities, Bureau of Mines, from records of the U. S. Department of Commerce)

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value (thousand dollars)	Short tons (unless otherwise stated)	Value (thousand dollars)
METALLIC				
Arsenic: Calcium arsenate—pounds	3,890,246	273	1,975,894	125
Aluminum:				
Ingots, slabs, crude	2,376	937	4,044	1,691
Scrap	4,581	1,476	39,338	12,985
Plates, sheets, bars, etc	7,764	6,107	6,050	4,803
Castings and forgings	622	1,661	619	1,795
Antimony: Metals and alloys, crude	[1] 25	23	44	26
Bauxite, including bauxite concentrates—long tons	27,907	886	16,174	666
Aluminum sulfate	14,373	534	14,503	576
Other aluminum compounds	6,084	931	6,390	1,674
Beryllium—pounds	[1] 19,333	[1] 92	21,151	68
Bismuth:				
Metals and alloys—do	[1] 127,010	[1] 301	137,856	186
Salts and compounds—do	51,570	247	62,581	268
Cadmium—do	65,866	60	998,959	1,422
Calcium chloride	11,572	371	10,987	374
Chrome:				
Ore and concentrate:				
Exports	1,166	56	864	50
Reexports	6,071	252	427	8
Chromic acid	312	171	397	216
Ferrochrome	607	286	2,105	996
Cobalt—pounds	382,630	[1] 363	3,067,386	1,173
Columbium metals, alloys and other forms—do	9	[2]	278	15
Copper:				
Ore, concentrate, composition metal, and unrefined copper (copper content)	495	290	2,369	1,309
Refined copper and semimanufactures	[1] 171,393	[1] 116,213	312,461	196,070
Other copper manufactures	294	352	250	308
Copper sulfate or blue vitriol	32,659	6,250	29,762	5,781
Copper base alloys	[3]	32,964	[3]	57,086
Ferroalloys:				
Ferrosilicon—pounds	3,395,617	288	4,160,243	365
Ferrophosphorus—do	45,918,473	1,148	48,683,806	793
Gold:				
Ore and base bullion—troy ounces	1,124	41	3,495	122
Bullion, refined—do	853,126	32,319	490,462	19,230
Iron ore—long tons	[1] 4,251,955	[1] 32,422	3,145,714	24,784
Iron and steel:				
Pig iron	18,837	1,074	10,247	762
Iron and steel products (major):				
Semimanufactures	[1] 1,813,542	[1] 281,344	1,867,711	303,791
Manufactured steel mill products	1,515,707	[1] 299,623	1,204,679	247,471
Advanced products	[2]	[1] 123,081	[2]	122,733
Iron and steel scrap: Ferrous scrap, including rerolling materials	316,542	11,219	1,683,103	51,256
Lead:				
Ore, matte, base bullion (lead content)	1,038	269	102	25
Pigs, bars, anodes:				
Exports	803	263	596	208
Reexports	799	188		
Scrap	2,706	523	3,894	838
Magnesium:				
Metal and alloys	2,722	1,718	3,096	1,738
Semifabricated forms, n. e. c	227	771	161	605
Powder	21	42	34	45
Manganese:				
Ore and concentrate	6,894	552	6,112	592
Ferromanganese	1,112	389	1,732	615
Mercury:				
Exports—flasks	546	106	890	183
Reexports—do	916	158	1,436	257
Molybdenum:				
Ore and concentrate—pounds	7,037,436	7,308	13,546,510	13,989
Metals and alloys, crude and scrap—do	21,826	13	34,358	37
Wire—do	15,980	235	10,563	196
Primary forms, mainly rods, sheets, and tubes—do	13,078	21	26,001	34
Powder—do	17,290	46	15,423	20
Ferromolybdenum—do	646,411	549	247,763	238

For footnotes, see end of table.

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TABLE 9.—Principal minerals and products exported from the United States, 1953–54—Continued

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value (thousand dollars)	Short tons (unless otherwise stated)	Value (thousand dollars)
METALLIC—continued				
Nickel:				
Alloys and scrap (including Monel metal)—do	22,846,005	8,868	27,517,514	10,865
Ingots, bars, sheet, etc—do	6,578,740	806		
Nickel-chrome electric resistance wire—do	356,222	609	299,186	522
Manufactures—do	555,993	936	671,151	1,069
Platinum:				
Ore and concentrate—troy ounces	30	(2)	29	2
Bars, ingots, sheets, wire, sponge, and other forms including scrap—troy ounces	2,522	238	13,470	1,148
Palladium, rhodium, iridium, osmiridium, ruthenium and osmium metals and alloys, including scrap—troy ounces	23,206	591	11,443	287
Platinum group manufactures except jewelry	(2)	1,555	(2)	1,801
Radium metal (radium content)—milligrams	1,056	35	419	15
Rare earths:				
Cerium ores, metal and alloy—pounds	83,659	278	29,461	129
Lighter flints—do	11,254	70	7,954	56
Silver:				
Ore and base bullion—troy ounces			29,917	25
Bullion, refined—do	1,022,773	871	1,672,618	1,451
Tantalum:				
Ore, metal, and other forms—pounds	172,246	119	52,461	93
Powder—do	62	3	110	5
Tin, ingots, pigs, bars, etc.:				
Exports—long tons	128	298	271	467
Reexports—do	75	142	551	1,125
Tin scrap and other tin-bearing material except tinplate scrap—long tons	5,237	2,418	8,269	3,341
Tin cans, finished or unfinished—do	29,841	12,917	23,878	11,022
Tin compounds—pounds	183,328	353	342,146	511
Titanium:				
Ore and concentrate	1 1,368	1 110	663	86
Metal and alloys in crude form and scrap	1 2	1 12	48	1,108
Semifabricated forms, n. e. c	31	1 798	164	3,567
Ferrotitanium	185	49	172	40
Dioxide and pigments	39,780	11,716	63,802	23,281
Tungsten, ore and concentrate:				
Exports	13	31	39	111
Reexports	22	61	149	239
Zinc:				
Ore, concentrate, dross (zinc content)	2,953	759		
Slabs, pigs or blocks	1 17,969	1 1,462	24,994	5,394
Sheets, plates, strips or other forms, n. e. s	4,628	2,637	4,045	2,183
Scrap (zinc content)	1,000	170	16,689	2,023
Dust	502	181	509	151
Semifabricated forms, n. e. c	286	151	543	257
Zirconium:				
Ore and concentrate	1,110	89	692	43
Metals and alloys and other forms—pounds	6,745	9	39,680	6
NONMETALLIC MINERALS				
Abrasives:				
Grindstones and pulpstones—pounds	864,357	53	714,227	47
Diamond dust and powder—carats	65,853	183	90,665	238
Diamond grinding wheels—do	110,847	546	129,868	554
Other natural and artificial metallic abrasives and products		17,754		19,856
Asbestos, unmanufactured:				
Exports	2,780	540	1,847	276
Reexports	296	52	47	15
Boron: Boric acid, borates, crude and refined—pounds	278,634,186	8,972	411,228,805	12,904
Bromine, bromides, and bromates—do	3,414,065	1,865	5,082,437	2,308
Cement—376-pound barrels	1 2,550,788	1 9,347	1,844,012	6,622
Clay:				
Kaolin or china clay	43,590	795	49,199	946
Fire clay	90,897	920	77,913	815
Other clays	167,901	5,316	200,602	6,582
Cryolite—long tons	117	35	72	24
Fluorspar	767	49	643	50
Graphite:				
Amorphous	1,571	154	608	67
Crystalline flake, lump or chip	94	38	49	19
Natural, n. e. s	95	8	141	20

For footnotes, see end of table.

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TABLE 9.—Principal minerals and products exported from the United States, 1953–54—Continued

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value (thousand dollars)	Short tons (unless otherwise stated)	Value (thousand dollars)
NONMETALLIC MINERALS—continued				
Gypsum:				
Crude, calcined, crushed	23,690	694	22,384	762
Plasterboard, wallboard, and tile—square feet	45,767,496	1,195	20,968,956	689
Manufactures, n. e. c.	(2)	105	(2)	150
Iodine, iodide, iodates—pounds	274,690	452	338,258	488
Kyanite and allied minerals	1,032	41	1,147	58
Lime	79,934	1,422	73,246	1,300
Mica:				
Unmanufactured—pounds	45,046	28	318,518	79
Manufactured:				
Ground or pulverized—do	4,560,883	240	6,058,118	343
Other—do	197,370	842	280,415	1,093
Mineral-earth pigments: Iron oxide, natural and manufactured	4,173	688	3,554	682
Nitrogen compounds (major)	[1] 133,538	[1] 9,245	332,655	14,867
Phosphate rock—long tons	2,100,798	18,368	2,385,013	21,169
Phosphatic fertilizers—do	259,215	6,611	393,114	11,752
Pigments and salts (lead and zinc):				
Lead pigments	2,473	799	2,570	872
Zinc pigments	6,898	1,468	6,124	1,352
Lead salts	152	83	355	162
Potash:				
Fertilizer	83,412	2,894	111,184	4,134
Chemical	4,796	1,042	6,202	1,330
Quartz crystal (raw)	(2)	5	(2)	41
Radioactive isotopes, etc.	(3)	[1] 533	(3)	536
Salt:				
Crude and refined	249,521	2,328	380,609	3,054
Shipments to noncontiguous Territories	8,980	632	9,650	782
Sodium and sodium compounds:				
Sodium sulfate	28,192	805	24,965	823
Sodium carbonate	165,405	5,819	163,548	5,527
Stone:				
Limestone, crushed, ground, broken	411,196	960	466,177	1,009
Marble and other building and monumental—cubic feet	153,105	2,204	127,341	2,396
Stone, crushed, ground, broken	691,811	704	508,940	703
Manufactures of stone	(2)	465	(2)	406
Sulfur:				
Crude—long tons	1,241,536	34,554	1,647,725	50,446
Crushed, ground, flowers of—do	29,475	[1] 2,020	30,130	2,162
Talc:				
Crude and ground	23,071	602	23,348	745
Manufactures, n. e. c.	159	96	259	111
Powders—talcum (face and compact)	(2)	1,296	(2)	1,076
FUELS				
Asphalt and bitumen, natural:				
Unmanufactured	20,513	1,098	29,868	1,474
Manufactures, n. e. c.	(2)	437	(2)	716
Carbon black—thousands of pounds	358,620	32,054	402,777	36,163
Coal:				
Anthracite	2,724,270	51,882	2,851,239	51,699
Bituminous	33,760,263	283,231	31,040,564	252,621
Briquets	102,907	1,677	98,908	1,627
Coke	520,252	9,269	384,377	6,248
Petroleum:				
Crude—thousands of barrels	19,932	59,970	13,599	45,026
Gasoline [4]—do	30,045	192,348	26,618	184,626
Kerosine—do	6,418	25,467	4,001	16,102
Distillate oil—do	29,661	105,758	21,931	80,876
Residual oil—do	19,810	39,116	20,338	39,438
Lubricating oil—do	12,258	178,532	14,482	197,854
Asphalt—do	1,525	10,384	1,598	10,013
Liquefied petroleum gases—do	2,955	12,786	3,912	15,692
Wax—do	1,127	19,125	1,340	25,983
Coke—do	3,612	14,042	3,214	12,175
Petrolatum—do	244	4,449	293	5,793
Miscellaneous products—do	986	14,510	1,014	16,152

[1] Revised figure.
[2] Less than $1,000.
[3] Weight not recorded.
[4] Includes naphtha but excludes benzol: 1953—30,000 barrels ($583,000); 1954—140,000 barrels ($1,889,000).

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TABLE 10.—Comparison of world and United States[1] production of principal metals and minerals, 1953–54

(Compiled under the supervision of Berenice B. Mitchell, Division of Foreign Activities, Bureau of Mines)

Mineral	1953			1954		
	World	United States		World	United States	
	Thousand short tons		Percent of world	Thousand short tons		Percent of world
Fuels:						
Coal:						
Bituminous	1,512,700	454,439	30	1,482,900	391,040	26
Lignite	495,000	2,851	(2)	517,000	2,843	(2)
Pennsylvania anthracite	151,300	30,949	20	152,100	29,083	19
Coke (excluding breeze):						
Gashouse	[3] 46,500	237	(2)	[3] 47,000	256	(2)
Oven and beehive	248,000	78,837	32	232,000	59,662	26
Fuel briquets and packaged fuel	118,000	1,860	2	117,000	1,701	1
Natural gas—million cubic feet	(4)	8,396,916	(4)	(4)	8,742,546	(4)
Peat	59,000	204	(2)	59,000	243	(2)
Petroleum (crude)—thousand barrels	4,770,779	2,357,082	49	4,990,899	2,316,323	46
Nonmetallic minerals:						
Asbestos	1,500	54	4	1,525	48	3
Barite	2,150	920	43	2,200	947	43
Cement—thousand barrels	1,042,400	267,669	26	1,142,900	275,857	24
Corundum	10			10		
Diamonds—thousand carats	20,096			20,440		
Diatomite	660	300	45	660	300	45
Feldspar [5]—thousand long tons	780	453	58	810	411	51
Fluorspar	1,340	318	24	1,300	246	19
Graphite	200	6	3	185	(6)	(6)
Gypsum	27,900	8,293	30	29,600	8,943	30
Magnesite	4,300	553	13	4,100	284	7
Mica (including scrap)—thousand pounds	255,000	147,367	58	285,000	162,808	57
Nitrogen, agricultural [5 7]	5,400	1,419	26	5,732	1,515	26
Phosphate rock—thousand long tons	26,000	12,504	48	29,200	13,821	47
Potash—K_2O equivalent	7,400	1,912	26	8,100	1,949	24
Pumice	3,200	1,348	42	3,600	1,647	46
Pyrites—thousand long tons	13,600	923	7	13,500	909	7
Salt	63,200	20,789	33	63,400	20,380	32
Sulfur, native—thousand long tons	5,800	5,155	89	6,200	5,516	89
Talc, pyrophyllite, and soapstone	1,690	632	37	1,840	592	32
Vermiculite [5]	224	190	85	243	196	81
Metals, mine basis:						
Antimony (content of ore and concentrate) [5]	35	(8)	1	40	(8)	2
Arsenic [5]	45	11	24	50	13	26
Bauxite—thousand long tons	13,425	1,580	12	15,550	1,995	13
Beryllium concentrate [5]	9	(9)	8	6	(9)	10
Bismuth—thousand pounds	4,200	(6)	(6)	3,800	(6)	(6)
Cadmium—do	15,380	9,767	64	15,540	9,552	61
Chromite	4,200	59	1	3,600	163	5
Cobalt (contained)	13	(10)	7	14	1	7
Columbium-tantalum concentrate—thousand pounds	5,780	15	(2)	9,625	33	(2)
Copper (content of ore and concentrate)	3,050	926	30	3,100	835	27
Gold—thousand fine ounces	33,700	1,970	6	35,100	1,859	5
Iron ore—thousand long tons	331,000	118,000	36	299,000	78,000	26
Lead (content of ore and concentrate)	2,090	343	16	2,230	325	15
Manganese ore (35 percent or more Mn)	10,600	158	1	9,700	206	2
Mercury—thousand 76-pound flasks	160	14	9	177	19	11
Molybdenum (content of ore and concentrate)—thousand pounds	62,600	57,243	91	65,500	58,668	90
Nickel (content of ore and concentrate)	223	(11)	(2)	242	3	1
Platinum group (Pt, Pd, etc.)—thousand troy ounces	775	26	3	825	24	3
Silver—thousand fine ounces	221,600	37,736	17	213,400	35,585	17
Tin (content of ore and concentrate) [5]—thousand long tons	180	(12)	(2)	179	(12)	(2)
Titanium concentrates:						
Ilmenite	1,081	514	48	1,092	548	50
Rutile	50	7	14	58	7	12
Tungsten concentrate—60 percent WO_3	79	10	13	77	14	18
Vanadium (content of ore and concentrate) [5]	6	5	83	6	5	83
Zinc (content of ore and concentrate)	2,920	547	19	2,920	467	16

For footnotes, see end of table.

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TABLE 10.—Comparison of world and United States [1] production of principal metals and minerals, 1953–54—Continued

Mineral	1953			1954		
	World	United States		World	United States	
	Thousand short tons		Percent of world	Thousand short tons		Percent of world
Metals, smelter basis:						
Aluminum	2,710	1,252	46	3,050	1,461	48
Copper	3,275	1,048	32	3,275	946	29
Iron, pig (incl. ferroalloys)	186,000	77,201	42	175,000	59,752	34
Lead	2,010	468	23	2,120	487	23
Magnesium	170	93	55	140	70	50
Steel ingots and castings	259,500	111,610	43	246,200	88,312	36
Tin thousand long tons	184	38	21	186	28	15
Zinc	2,560	916	36	2,650	802	30

[1] Including Alaska and Puerto Rico.
[2] Less than 1 percent.
[3] Includes low- and medium-temperature and gashouse coke.
[4] Data not available.
[5] World total exclusive of U. S. S. R.
[6] Bureau of Mines not at liberty to publish United States figure separately.
[7] Year ended June 30 of year stated (United Nations).
[8] In 1953 United States production of antimony was 372 short tons and in 1954, 764 short tons.
[9] In 1953 United States production of beryl was 751 short tons and in 1954, 642 short tons.
[10] In 1953 United States production of cobalt was 888 short tons.
[11] In 1953 United States production of nickel was 602 short tons.
[12] In 1953 United States production of tin was 56 long tons and in 1954, 200 long tons.

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Employment and Injuries in the Mineral Industries

By John C. Machisak [1]

THIS CHAPTER of volume III of Minerals Yearbook, 1954, contains overall employment and related injury experience at bituminous-coal, lignite, and anthracite mines, coking plants, metal and nonmetal mines, metallurgical plants, and stone quarries in the United States.

Volume I includes data on employment and injuries in the metal and nonmetal industries and volume II those in the fuel industries—coal, coke, oil, and gas.

Data on injuries, with related employment, were obtained by Bureau of Mines surveys conducted on a purely voluntary basis, except that for the coal-mining industry, which is required by law to furnish the necessary information. Every effort has been made to present complete coverage for the Nation's mineral industries and to show the hazards to which workers are exposed in each of these industries.

TABLE 1.—Salient statistics of employment and injury experience in the mineral industries in the United States, 1950–54, by industry groups

	1950	1951	1952	1953	1954
Average number of men working daily: [1]					
Coal mines	483,239	441,905	401,329	351,126	283,705
Metal mines	68,292	71,603	74,626	72,529	66,610
Nonmetal mines (except stone quarries)	11,977	12,500	12,447	12,765	12,810
Stone quarries	85,730	84,802	81,879	83,641	78,910
Coke plants	24,347	25,715	25,241	23,440	19,209
Metallurgical plants	46,277	48,019	49,032	55,283	54,396
Total	719,862	684,544	644,554	598,784	515,640
Average number of active mine-days: [2]					
Coal mines	189	202	189	187	175
Metal mines	271	278	265	270	245
Nonmetal mines (except stone quarries)	293	298	288	292	284
Stone quarries	272	277	279	278	273
Coke plants	341	344	315	345	342
Metallurgical plants	314	318	319	318	307
Total	221	235	226	230	222
Man-days worked, thousand:					
Coal mines	91,231	89,365	76,003	65,688	49,598
Metal mines	18,522	19,913	19,770	19,559	16,294
Nonmetal mines (except stone quarries)	3,512	3,729	3,588	3,727	3,638
Stone quarries	23,347	23,470	22,844	23,248	21,506
Coke plants	8,292	8,834	7,939	8,086	6,567
Metallurgical plants	14,539	15,247	15,628	17,603	16,712
Total	159,443	160,558	145,772	137,911	114,315

See footnotes at end of table.

[1] Acting chief, Branch of Accident Analysis, Division of Safety.

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TABLE 1.—Salient statistics of employment and injury experience in the mineral industries in the United States, 1950–54, by industry groups—Continued

	1950	1951	1952	1953	1954
Man-hours worked, thousand:					
Coal mines	711,389	697,247	593,698	513,594	387,950
Metal mines	147,765	159,417	158,649	156,605	130,489
Nonmetal mines (except stone quarries)	28,456	30,130	28,955	30,488	29,564
Stone quarries	189,535	191,113	186,552	189,776	175,817
Coke plants	65,861	70,191	62,803	64,677	52,482
Metallurgical plants	116,430	122,088	124,967	138,811	133,675
Total	1,259,436	1,270,186	1,155,624	1,093,951	909,977
Number of injuries:					
Fatal:					
Coal mines	643	785	548	461	396
Metal mines	84	95	117	92	86
Nonmetal mines (except stone quarries)	19	17	14	22	9
Stone quarries	54	57	74	43	34
Coke plants	14	10	8	8	8
Metallurgical plants	29	16	16	12	16
Total	843	980	777	638	549
Nonfatal:					
Coal mines	37,264	35,553	30,074	24,258	17,718
Metal mines	6,611	6,824	6,684	6,164	4,994
Nonmetal mines (except stone quarries)	1,238	1,351	1,171	1,419	956
Stone quarries	4,762	4,945	4,503	4,450	3,834
Coke plants	780	768	546	425	254
Metallurgical plants	2,574	2,714	2,853	2,824	2,578
Total	53,229	52,155	45,831	39,540	30,334
Injury rates per million man-hours:					
Fatal:					
Coal mines	0.90	1.13	0.92	0.90	1.02
Metal mines	.57	.60	.74	.59	.66
Nonmetal mines (except stone quarries)	.67	.56	.48	.72	.30
Stone quarries	.28	.30	.40	.23	.19
Coke plants	.21	.14	.13	.12	.15
Metallurgical plants	.25	.13	.13	.09	.12
Total	.67	.77	.67	.58	.60
Nonfatal:					
Coal mines	52.38	50.99	50.66	47.23	45.67
Metal mines	44.74	42.81	42.13	39.36	38.27
Nonmetal mines (except stone quarries)	43.51	44.84	40.44	46.54	32.34
Stone quarries	25.12	25.87	24.14	23.45	21.81
Coke plants	11.84	10.94	8.69	6.57	4.84
Metallurgical plants	22.11	22.23	22.83	20.34	19.29
Total	42.26	41.06	39.66	36.14	33.33

[1] Average number of men at work each day mine was active. Because absenteeism and labor turnover are taken into consideration, this number is lower than number of men available for work as measured by a count of names on payroll.
[2] Average in which operating time of each mine is weighed by average number of workers in mine.

Employment in the mineral industries declined from an average of 598,784 men working daily in 1953 to 515,640, a 14-percent decrease; man-hours of work during the same period fell 17 percent. The average length of shift remained relatively unchanged between 1953 and 1954, but the total number of hours per man-year declined 3 percent.

The injury experience showed 89 fewer fatalities than the number reported in 1953 and 9,206 fewer nonfatal injuries with an overall injury rate (fatal and nonfatal) of 33.93 per million man-hours of employment, against a similar rate of 36.72 for the previous year.

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One major disaster (a single accident in which five or more men are killed) occurred in a West Virginia coal mine as a result of a gas explosion. Fifteen underground employees and one surface employee were killed in this disaster.

The fatality experience of the mineral industries improved in only two sections for 1954—nonmetal mines and stone quarries—with decreases of 58 and 17 percent, respectively. All other sections were not as favorable, and the overall fatality rate rose from 0.58 in 1953 to 0.60 in 1954, an increase of 3 percent. The nonfatal-injury experience however, showed marked improvement in all sections, with an 8-percent decline from 36.14 in 1953 to 33.33 in 1954. Greatest improvements reported were in the nonmetal and coking industries; decreases of 31 and 26 percent, respectively, were noted.

Work Stoppages.—There were 281 work stoppages in the mineral industries during 1954, according to the Bureau of Labor Statistics. Most of these (208) occurred in the bituminous-coal-mining industry, resulting in a loss of 344,000 man-days of work; the anthracite industry experienced 19, for a loss of 76,000 man-days; nonmetal mining and quarries had 14 and metal mining 9, incurring losses of 33,000 and 392,000 man-days, respectively. The remaining 31 work stoppages were distributed as follows: 20 at cement plants, 10 in petroleum refineries, and 1 at coke and byproduct plants, causing a loss of 156,000 additional man-days. There were 192 fewer work stoppages in the mineral industries during 1954 than in 1953; however, the total loss in man-days due to work stoppages was 86,000 greater, or approximately 9 percent. Thus the average duration of the work stoppages was somewhat longer in 1954 than in the previous year.

Average Earnings.—The average hourly earnings for 1954 increased slightly in all mineral industries except bituminous coal, which was identical with that reported for 1953, and lead-zinc, which was $1.89 in 1954 and $1.92 for 1953.

Labor Turnover.—The data published by the Bureau of Labor Statistics show a slight decline in the accession rates in each mineral-industry group and also in the separation rates, except for the anthracite and bituminous-coal and iron-industry groups.

TABLE 2.—Work stoppages, average earnings, and labor turnover in certain mineral industries in the United States, 1950–54

Industry and year	Work stoppages [1]		Average earnings [2]		Labor-turnover rates [3]	
	Number	Man-days lost (thousands)	Weekly	Hourly	Accession	Separation
Coal mining:						
Anthracite:						
1950	41	80	$63.24	$1.97	1.8	1.8
1951	30	81	66.66	2.20	1.9	2.3
1952	41	104	71.19	2.26	1.4	2.2
1953	24	108	72.91	2.48	1.4	3.1
1954	19	76	75.60	2.52	1.3	5.2
Bituminous:						
1950	430	9,320	70.35	2.01	[4] 2.0	[4] 2.5
1951	549	887	77.79	2.21	1.9	2.6
1952	560	2,760	78.09	2.29	1.9	2.8
1953	392	418	85.31	2.48	1.3	2.6
1954	208	[5] 344	80.85	2.48	1.2	3.2

See footnotes at end of table.

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TABLE 2.—Work stoppages, average earnings, and labor turnover in certain mineral industries in the United States, 1950–54—Continued

Industry and year	Work stoppages [1]		Average earnings [2]		Labor-turnover rates [3]	
	Number	Man-days lost (thousands)	Weekly	Hourly	Accession	Separation
Metal mining:						
Total:						
1950	14	235	$65.58	$1.55	4.6	4.2
1951	23	269	74.56	1.71	5.3	4.9
1952	29	1,300	81.65	1.86	5.8	5.7
1953	15	255	88.54	2.04	4.3	4.7
1954	9	392	84.46	2.07	3.2	4.1
Iron:						
1950	(5)	(5)	61.96	1.52	2.6	2.5
1951	(5)	(5)	72.68	1.71	2.8	2.5
1952	(5)	(5)	80.34	1.83	2.9	2.9
1953	(5)	(5)	90.74	2.14	1.9	2.1
1954	(5)	(5)	82.03	2.17	1.6	4.3
Copper:						
1950	(5)	(5)	72.05	1.60	5.3	4.4
1951	(5)	(5)	78.54	1.70	5.1	4.8
1952	(5)	(5)	85.73	1.88	5.4	5.1
1953	(5)	(5)	91.60	2.00	4.8	4.8
1954	(5)	(5)	87.33	2.05	3.6	3.9
Lead-zinc:						
1950	(5)	(5)	66.64	1.60	4.4	3.9
1951	(5)	(5)	76.11	1.77	5.2	4.7
1952	(5)	(5)	81.60	1.92	4.4	4.5
1953	(5)	(5)	80.06	1.92	2.7	4.9
1954	(5)	(5)	76.73	1.89	2.1	2.2
Nonmetal mining and quarrying:						
Total:						
1950	22	64	59.88	1.36	(5)	(5)
1951	24	53	67.05	1.49	(5)	(5)
1952	17	94	71.10	1.58	(5)	(5)
1953	26	63	75.99	1.70	(5)	(5)
1954	14	33	77.44	1.76	(5)	(5)
Cement:						
1950	12	57	60.13	1.44	2.2	2.1
1951	12	12	65.21	1.56	2.9	2.8
1952	(5)	(5)	67.72	1.62	2.7	2.6
1953	5	20	73.39	1.76	2.5	2.6
1954	20	113	75.71	1.82	1.6	1.5
Coke and byproducts:						
1950	2	2	62.85	1.58	(5)	(5)
1951	4	11	69.39	1.66	(5)	(5)
1952	(5)	(5)	73.74	1.76	(5)	(5)
1953	2	1	78.81	1.89	(5)	(5)
1954	1	7	80.73	1.95	(5)	(5)
Petroleum refining:						
1950	10	638	77.93	1.93	.8	.8
1951	8	37	84.66	2.08	1.2	.8
1952	4	46	88.44	2.20	1.0	.8
1953	9	50	94.19	2.32	.8	.9
1954	10	36	96.22	2.37	.5	.7

[1] Number of stoppages beginning during the year and man-days of work lost from only these stoppages during the year.
[2] Monthly averages for production and related workers only; data cover both full- and part-time employees who worked during or received pay for the pay period ended nearest the 15th of the month.
[3] Monthly averages expressed as the number per 100 employees. Accessions are all additions to the work force, whether new or rehired employees; separations and all terminations of employment, including quits, discharges, layoffs, and military and miscellaneous separations. Data for metal mining, cement, and petroleum refining for 1950 are not comparable with preceding years due to changes in industry classification by the U. S. Department of Labor.
[4] 11-month average due to strike during February.
[5] Figure not available.

NATIONAL SAFETY COMPETITION

Safety competitions, sponsored and conducted annually by the Bureau of Mines, have proved effective in promoting accident-prevention work in the mineral industries. An encouraging number of mineral plants (751) enrolled in the National Safety Competition

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and the National Sand and Gravel Competition reported outstanding safety records in 1954. Of the establishments enrolled in these 2 contests, 304 (40 percent) attained injury-free records. The aggregate worktime of these injury-free plants was almost 23 million man-hours, this amount being 17 percent of the total time worked at all participating plants in these 2 National Competitions. The total man-hours worked in 1954 was 138,145,404. In addition, the Bureau of Mines conducted four other competitions, sponsored annually by national associations connected with the mineral industries. These associations were: National Sand and Gravel, National Lime, National Crushed Stone, and National Slag. In these contests, of the 308 plants enrolled in 1954, 116 (38 percent) had injury-free records during an aggregate worktime exceeding 29 million man-hours.

Trophy awards for the best safety record in each of the 6 groups in the 1954 National Safety Competition were made to the following:

Anthracite Underground Mines.—The No. 5 Hill mine of the Ploskonka Coal Co., Archbald, Pa.

Bituminous-Coal Underground Mines.—The Labuco mine of the Alabama By-Products Corp., Birmingham, Ala.

Metal Underground Mines.—The Zenith mine of Pickands Mather & Co. (the Vermillion Mining Co.), Ely, Minn.

Nonmetal Underground Mines.—The No. 6 mine of United States Gypsum Co., Plasterco, Va.

Open-Pit Mines.—The Mahoning mine of Pickands Mather & Co. (Mahoning Ore & Steel Co.), Hibbing, Minn.

Quarries.—The Thornton quarry of the Material Service Corp., Thornton, Ill.

TABLE 3.—Employment and injury experience of the United States mineral industries, 1931–54

Year	Men working daily	Average active days	Man-days worked	Man-hours worked	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
1931	784,347	188	147,602,799	1,288,135,808	1,707	94,021	1.33	72.99
1932	671,343	165	110,655,616	962,924,915	1,368	66,028	1.42	68.57
1933	677,722	181	122,787,658	1,058,245,650	1,242	70,158	1.17	66.30
1934	739,817	195	144,566,133	1,167,723,543	1,429	79,211	1.22	67.83
1935	783,139	195	152,354,170	1,215,316,764	1,495	80,070	1.23	65.88
1936	824,514	216	177,920,334	1,426,233,543	1,686	90,608	1.18	63.53
1937	859,951	217	186,790,283	1,482,241,908	1,759	94,466	1.19	63.73
1938	774,894	187	145,056,875	1,144,137,296	1,369	69,940	1.20	61.13
1939	788,925	202	159,388,490	1,251,169,210	1,334	73,253	1.07	58.55
1940	801,926	219	175,663,792	1,385,128,234	1,716	80,856	1.24	58.37
1941	835,095	234	195,425,228	1,541,335,277	1,621	87,911	1.05	57.04
1942	802,640	260	208,739,906	1,653,284,620	1,862	91,675	1.13	55.45
1943	747,486	277	207,350,643	1,668,340,394	1,799	88,449	1.08	53.02
1944	676,938	287	194,512,359	1,618,479,042	1,571	83,451	.97	51.56
1945	637,220	271	172,672,431	1,437,533,530	1,270	73,411	.88	51.07
1946	676,254	240	162,630,674	1,354,822,190	1,167	72,805	.86	53.74
1947	721,792	256	185,076,018	1,496,101,097	1,407	76,919	.94	51.41
1948	740,988	249	184,551,937	1,457,690,518	1,227	70,939	.84	48.67
1949	723,390	205	148,304,347	1,170,590,880	760	51,576	.65	44.06
1950	719,862	221	159,443,478	1,259,436,140	843	53,229	.67	42.26
1951	684,544	235	160,558,417	1,270,186,435	980	52,155	.77	41.06
1952	644,554	226	145,771,805	1,155,623,605	777	45,831	.67	39.66
1953	598,784	230	137,910,860	1,093,950,835	638	39,540	.58	36.14
1954	515,640	222	114,314,878	909,977,122	549	30,334	.60	33.33

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The Mineral Industry of Alabama

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Geological Survey of Alabama.

By Avery H. Reed, Jr.[1] and Walter B. Jones[2]

THE PRINCIPAL mineral industries of Alabama in 1954 included those devoted to the production of coal, iron ore, stone, petroleum, sand and gravel, and clays as primary crude materials and the manufacture of coke, steel, pig iron, aluminum, cement, and lime. Among the States, Alabama ranked second in the output of bauxite and third in iron ore.

The mineral industry of Alabama was dominated by the coal and iron-ore mining and processing industries. Leading companies were the Tennessee Coal & Iron Division, United States Steel Corp., operating coal, iron-ore, and limestone mines and a limekiln in Jefferson County; the Woodward Iron Co., operating coal and iron-ore mines in Jefferson County; the Alabama Power Co., operating coal mines in Walker County; the Lone Star Cement Co., operating a cement plant in Jefferson County, a cement plant in Marengo County, a clay mine in Jefferson County, and limestone quarries in Jefferson, Marengo, and Washington Counties; and the Republic Steel Corp., operating coal and iron-ore mines in Jefferson County.

Much of the State's mineral industry was concentrated near Birmingham, the largest city.

The year 1954 witnessed a decline of 19 percent in total value of mineral production compared with 1953, the record year. New all-time highs were recorded in the portland-cement, sand and gravel, and salt industries. Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

Defense Minerals Exploration Administration (DMEA) activity included four sheet-mica projects in Clay and Randolph Counties.

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TABLE 1.—Mineral production in Alabama, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement.....376-pound barrels	[2] 10,427,542	[2] $25,701,421	[2] 11,121,599	[2] $28,582,683
Clays	1,198,093	1,815,606	1,330,900	2,258,211
Coal	12,532,061	79,370,036	10,282,506	64,029,502
Iron ore (usable).....long tons	7,446,130	55,640,338	5,913,462	33,327,083
Lime	470,541	5,018,156	421,807	4,488,167
Mica	(3)	(3)	(3)	14,956
Natural gas (marketed production) million cubic feet	41	2,000	87	5,000
Petroleum (crude) thousand 42-gallon barrels	1,694	3,290,000	1,584	3,690,000
Sand and gravel	3,710,707	3,002,683	3,966,345	3,450,858
Stone	[4] [5] 3,957,452	[4] [5] 8,154,467	7,393,530	11,608,937
Undistributed: Asphalt (native), bauxite, pozzolan cement, graphite (1953), salt, and minerals whose values must be concealed for particular years (indicated in appropriate column by footnote reference 3)	----------	[5] [6] 5,092,087	----------	4,840,589
Total Alabama	----------	[5] 187,087,000	----------	[7] 151,330,000

[1] Production as measured by marketable production, mine shipments or sales (including consumption by producers), except that bauxite is strictly production.
[2] Excludes pozzolan cement, value for which is included with "Undistributed."
[3] Figure withheld to avoid disclosure of individual company operations. Value included with "Undistributed."
[4] Except limestone for cement and lime.
[5] Revised figure.
[6] Excludes value of clays for cement.
[7] The total has been adjusted to eliminate duplications in the value of clays and stone.

TABLE 2.—Average unit values of minerals produced in Alabama, 1945–49 (average) and 1950–54, in dollars per unit [1]

Mineral	1945–49 (average)	1950	1951	1952	1953	1954
Bauxite.....long ton	$5.52	$5.88	$6.02	$6.20	$7.31	$6.50
Cement:						
Portland.....376-pound bbl	1.81	2.19	2.32	2.36	2.46	2.57
Pozzolan.....do	(2)	----------	3.16	2.96	3.16	3.30
Clays:						
Fire.....short ton	2.06	1.76	3.48	3.44	2.88	4.18
Kaolin.....do	9.40	9.71	5.00	5.00	9.67	9.94
Miscellaneous.....do	.73	.77	.84	1.07	.99	1.04
Coal.....do	5.35	6.13	6.06	6.22	6.33	(2)
Graphite.....do	96.56	96.13	----------	117.92	----------	----------
Iron ore:						
Hematite.....long ton	3.13	3.88	4.08	5.16	7.70	5.74
Limonite.....do	2.99	3.11	3.29	5.71	5.35	5.12
Lime.....short ton	7.89	9.20	9.64	10.51	10.66	10.64
Limestone:						
Crushed.....do	1.32	1.54	1.89	1.57	1.51	1.28
Dimension.....do	----------	48.27	53.47	47.90	145.14	43.75
Marble:						
Crushed.....do	3.79	3.97	(2)	(2)	9.02	4.83
Dimension.....do	151.69	150.85	149.25	112.04	98.14	124.09
Mica:						
Scrap.....do	1.84	----------	----------	16.55	----------	20.00
Sheet.....pound	2.36	----------	----------	1.41	6.09	2.75
Salt.....short ton	----------	----------	----------	1.08	1.08	1.08
Sand.....do	(2)	.70	.83	.71	.76	.87
Gravel.....do	(2)	.67	.77	.86	.84	.87
Sandstone:						
Crushed.....do	4.17	6.61	8.90	8.90	9.09	5.64
Dimension.....do	----------	----------	----------	15.85	13.46	17.43
Stone, miscellaneous.....do	----------	----------	1.35	----------	----------	----------

[1] For greater detail on prices by grades and markets, see volume I, Minerals Yearbook 1954.
[2] Figure withheld to avoid disclosure of individual company operations.

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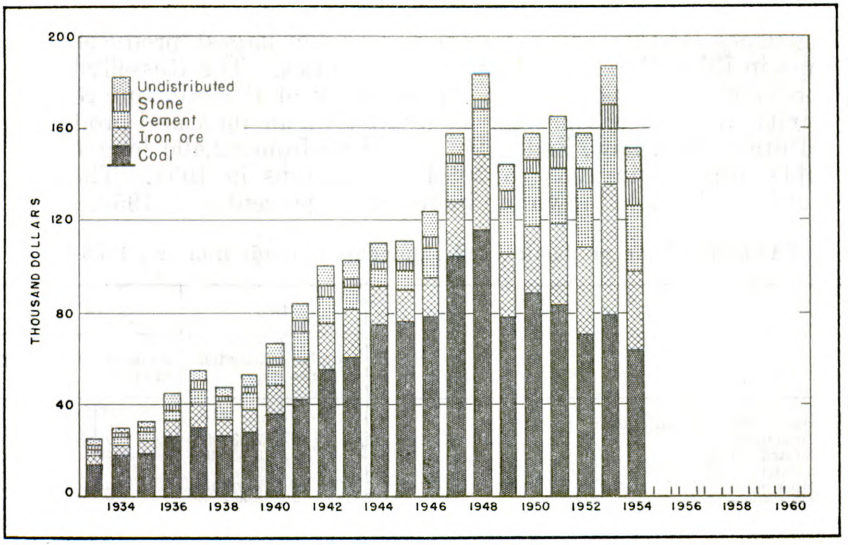

FIGURE 1.—Value of mineral production in Alabama, 1933–54.

REVIEW BY MINERAL COMMODITIES

METALS

Bauxite.—Two companies produced crude bauxite for chemicals and refractories; production declined 27 percent from 1953. The leading producer was the Aluminum Co. of America, with mines in Barbour County.

Iron Ore.—Total shipments of iron ore decreased 21 percent below 1953 to the lowest level since 1938, reflecting the increasing use of foreign ore in the Birmingham district. Of the total quantity shipped, 54 percent was direct shipping ore, compared with 59 percent in 1953; 36 percent was concentrate, compared with 26 percent in 1953; and 10 percent was sinter, compared with 15 percent in 1953. The number of mines operating increased from 30 to 33, and the average usable production per mine declined from 248,000 tons to 179,000.

Five companies mined red iron ore near Birmingham. The Republic Steel Corp. operated the Edwards mine and shipped a small quantity of tailing from the old Spaulding concentrating plant; during the year work was begun on a new concentrating plant near the Spaulding mine. The Southeastern Coal & Iron Co. opened a new open-pit mine near Trussville. The Tennessee Coal & Iron Division of United States Steel Corp., the largest producer, operated the Muscoda and Wenonah groups of mines and treated the entire mine production in its ore-conditioning plant. The United States Pipe & Foundry Co. operated the Sloss red-ore mine. The Woodward Iron Co. operated the Pyne, Songo, and Woodward red-ore mines; the ore from the Pyne mine was treated at the concentrating plant. Total hematite shipments decreased 26 percent below 1953.

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Twenty operators mined brown iron ore at 24 mines in 11 counties. The Shook & Fletcher Supply Co. was the largest producer, with mines in Bibb, Blount, and Franklin Counties. The Russellville and Woodstock districts supplied the majority of the ore, but renewed activity in the Geenville district resulted in an increased production in Butler, Crenshaw, and Pike Counties—from 82,400 long tons of usable iron ore in 1953 to 205,400 long tons in 1954. The total shipment of usable brown ore increased 33 percent over 1953.

TABLE 3.—Mine production and shipments of crude iron ore, 1953–54

	1953		1954	
	Number of mines	Long tons	Number of mines	Long tons
Mine production by varieties:				
Hematite	10	7,339,415	9	5,016,274
Brown ore	20	3,630,900	24	4,669,553
By mining method:				
Open pit	22	3,975,618	26	4,730,954
Underground	8	6,994,697	7	4,954,873
Shipments from mines:				
Direct to consumers	7	4,443,123	8	3,470,060
To beneficiation plants	23	6,520,920	25	6,225,836

TABLE 4.—Production and shipments of usable iron ore, 1953–54

	1953		1954	
	Long tons	Iron content, natural (percent)	Long tons	Iron content, natural (percent)
Production of usable iron ore by varieties:				
Hematite	6,736,109	37	4,925,272	36
Brown ore	726,270	46	978,049	47
Shipments of usable iron ore by types:				
Direct shipping ore	4,428,070	36	3,188,438	36
Concentrate	1,925,887	40	2,118,824	39
Sinter	1,092,173	49	606,200	40

TABLE 5.—Shipments of usable iron ore, 1945–49 (average) and 1950–54

Year	Long tons	Value	Year	Long tons	Value
1945–49 (average)	6,915,649	$23,107,805	1952	7,243,214	$37,940,412
1950	7,402,208	28,932,801	1953	7,446,130	55,640,338
1951	8,181,737	34,799,951	1954	5,913,462	33,327,083

NONMETALS

Cement.—Seven companies produced portland cement at 8 plants in 5 counties; the total shipped was 7 percent over 1952, a new record. The leading producer was the Lone Star Cement Co., with plants in Jefferson and Marengo Counties. Two companies produced pozzolan cement.

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TABLE 6.—Shipments of portland cement, 1945–49 (average) and 1950–54

Year	376-pound barrels	Value	Year	376-pound barrels	Value
1945–49 (average)	8,521,463	$15,720,750	1952	10,642,409	$25,084,379
1950	10,574,955	23,175,772	1953	10,427,542	25,701,421
1951	10,586,825	24,523,073	1954	11,121,599	28,582,683

Clays.—Fourteen companies mined fire clay at 14 mines in 8 counties; production declined 7 percent. The largest producer was the Natco Corp., with operations in Walker County.

TABLE 7.—Fire clay sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	131,307	$269,648	1952	220,009	$757,451
1950	167,779	295,764	1953	252,926	727,439
1951	203,339	707,030	1954	235,731	985,960

TABLE 8.—Fire clay sold or used by producers, 1953–54, by uses

Use	1953		1954	
	Short tons	Value	Short tons	Value
Heavy clay products	136,502	$354,078	103,694	$656,349
Firebrick and block	44,253	229,032	(1)	(1)
Foundries and steelworks	(1)	(1)	43,499	99,956
Fire-clay mortar	38,140	99,402	(1)	(1)
Art pottery	(1)	(1)	50	250
Stoneware	(1)	(1)	40	200
Other	34,031	44,927	88,448	229,205
Total	252,926	727,439	235,731	985,960

[1] Figure withheld to avoid disclosure of individual company operations. Included with "Other."

The Thomas Alabama Kaolin Co. was the only producer of kaolin, with operations in Marion County; production declined 14 percent. The kaolin was used for paper and paint filler and for firebrick and block.

Miscellaneous clay figures for 1954 include clays sold or used for manufacturing portland cement. Twenty-four companies mined miscellaneous clay at 24 mines in 12 counties. The largest producer was the Ideal Cement Co., with operations in Mobile County. Production was 1,080,000 tons valued at $1,126,000. The clay was used for cement and heavy clay products.

Lime.—Eight companies produced lime at 8 plants in 3 counties; production declined 10 percent. The largest producer was the Southern Cement Co., with operations in Shelby County.

TABLE 9.—Lime sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	340,603	$2,689,481	1952	424,028	$4,458,604
1950	389,071	3,577,850	1953	470,541	5,018,156
1951	455,953	4,395,922	1954	421,807	4,488,167

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TABLE 10.—Lime sold or used by producers, 1953–54, by uses

	1953		1954	
	Short tons	Value	Short tons	Value
Chemical and industrial	376,155	$3,974,181	333,101	$3,503,887
Building	80,001	851,774	81,888	892,880
Other	14,385	192,201	6,818	91,400
Total	470,541	5,018,156	421,807	4,488,167

Mica.—Ten or more companies or individuals mined crude mica at 14 mines in 5 counties; production was considerably greater than in 1953. The largest producer was the Inlow Mica Co., with operations in Chilton County. Production of sheet mica was more than five times that in 1953. The Inlow Mica Co. mined scrap mica for grinding and built a new dry-grinding mill in Chilton County. Total mica production was valued at $15,000.

Salt.—The Mathieson Chemical Corp. produced salt from brine at its plant in Washington County; production increased 4 percent, establishing a new record for the State.

Sand and Gravel.—Thirty-nine companies mined sand and gravel at 46 mines in 28 counties; production increased 7 percent and exceeded that in any previous year. The largest producer was the Birmingham Slag Co., with mines in Montgomery County.

TABLE 11.—Sand and gravel sold or used by producers, 1945–49 (average) and 1950–54

	Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	(1)	(1)	(1)	(1)	3,176,233	$2,092,742
1950	1,392,692	$979,522	2,223,671	$1,484,200	3,616,363	2,463,722
1951	(1)	(1)	(1)	(1)	3,535,871	2,806,540
1952	(1)	(1)	(1)	(1)	3,722,555	2,955,630
1953	1,570,826	1,196,831	2,139,881	1,805,852	3,710,707	3,002,683
1954	1,516,997	1,316,769	2,449,348	2,134,089	3,966,345	3,450,858

[1] Figure withheld to avoid disclosure of individual company operations.

TABLE 12.—Sand and gravel sold or used by producers, 1953–54, by uses

Use	1953		1954	
	Short tons	Value	Short tons	Value
Paving	1,436,105	$1,103,139	1,997,670	$1,592,660
Structural	1,616,574	1,407,865	1,396,766	1,391,841
Railroad ballast	432,005	234,494	271,598	135,435
Engine sand	(1)	(1)	74,754	37,333
Molding sand	(1)	(1)	65,982	112,357
Other	226,023	257,185	159,575	181,232
Total	3,710,707	3,002,683	3,966,345	3,450,858

[1] Figure withheld to avoid disclosure of individual company operations. Included with "Other."

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Stone.—Figures for 1954 include crushed limestone for cement and lime manufacture. Twenty-two companies produced crushed limestone at 27 quarries in 12 counties. The largest producer was the Tennessee Coal & Iron Division of United States Steel Corp., with operations in Jefferson County. The 1954 production of crushed limestone, excluding limestone for cement and lime, decreased 13 percent from 1953, due mainly to decreased demand for fluxing stone

TABLE 13.—Crushed limestone sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)[1]	2,276,930	$2,992,457	1952[1]	2,936,029	$6,051,287
1950[1]	2,447,960	3,777,022	1953[1]	[2] 3,815,076	[2] 5,779,804
1951[1]	2,700,064	5,103,858	1954	7,195,748	9,237,726

[1] Except for cement and lime.
[2] Revised figure.

TABLE 14.—Crushed limestone sold or used by producers, 1953–54, by uses

Use	1953[1]		1954	
	Short tons	Value	Short tons	Value
Cement manufacture	(1)	(1)	3,238,835	$3,489,099
Fluxing stone	2,289,242	$3,468,741	1,952,840	2,979,938
Concrete and road metal	[2] 892,597	[2] 1,234,307	704,510	901,800
Lime manufacture	(1)	(1)	625,709	765,894
Agriculture	198,238	255,596	404,896	553,784
Railroad ballast	107,313	160,969	(3)	(3)
Riprap	84,924	124,232	(3)	(3)
Rock dusting	54,561	238,218	45,397	192,117
Other	188,201	297,741	223,561	355,094
Total	[2] 3,815,076	[2] 5,779,804	7,195,748	9,237,726

[1] Cement and lime manufacture not included in total.
[2] Revised figure.
[3] Figure withheld to avoid disclosure of individual company operations. Included with "Other."

The Alabama Limestone Co. quarried dimension limestone for rubble, rough architectural, and sawed and cut dressed building stone at its operations in Franklin County. Production was 18,300 tons valued at $802,700.

Three companies produced crushed marble at 3 quarries in Talladega County; production was 125,000 tons valued at $603,500. The largest producer was Thompson-Weinman & Co. The crushed marble was used for terrazzo and whiting.

Two companies quarried dimension marble at 2 quarries in Talladega County; production was 59,100 cubic feet valued at $623,800. The largest producer was the Moretti Harrah Marble Co. The marble was used for rough building stone, cut and sawed interior dressed building stone, and cut dressed monumental stone.

Four companies produced crushed sandstone at 4 quarries in 4 counties; production was 44,000 tons valued at $248,300. The largest producer was the Jackson County Highway Department, with operations in Jackson County. The crushed sandstone was used for concrete and road metal, refractories, and foundries.

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Four companies quarried dimension sandstone at 4 quarries in 3 counties; production was 5,300 tons valued at $92,000, compared with 500 tons valued at $7,100 in 1953. The largest producer was the Sand Valley Stone Co., with operations in Jefferson County. The sandstone was used for rubble, rough architectural stone, dressed building stone, and flagging.

FUELS

For more data on fuels, see volume II, Minerals Yearbook, 1954.

Coal.—The production of coal was centered in the Warrior coal field near Birmingham. Leading counties were Jefferson, Walker, and Tuscaloosa. Leading companies were the Alabama Power Co., Tennessee Coal & Iron Division of United States Steel Corp., Republic Steel Corp., Woodward Iron Co., and United States Pipe & Foundry Co. Production declined 18 percent below 1953, owing mainly to decreased demand for coke.

TABLE 15.—Coal production, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	17,040,569	$90,659,704	1953	12,532,061	$79,370,036
1950	14,421,810	88,343,572	1954	10,282,506	64,029,502
1951	13,596,982	82,465,625			
1952	11,383,427	70,759,815	Earliest record to date	884,495,000	(1)

[1] Data not available.

Natural Gas.—Marketed production of natural gas was 87 million cubic feet valued at $5,000 compared with 41 million cubic feet valued at $2,000 in 1953. Natural gas was produced in the Gulf Coast area near Mobile. The apparent great increase in 1954 was due to additional pipeline installations.

TABLE 16.—Marketed production of natural gas, 1950–54

Year	Cubic feet	Value	Year	Cubic feet	Value
1950	2,000,000	$100	1953	41,000,000	$2,000
1951	1,000,000	50	1954	87,000,000	5,000
1952	4,000,000	160			

Petroleum.—Production of crude petroleum declined 6 percent below 1953. Production was centered in the area along the gulf coast near Mobile. Producing counties were Baldwin, Choctaw, Clark, Escambia, Marion, and Mobile.

TABLE 17.—Production of crude petroleum, 1945–49 (average) and 1950–54

Year	42-gallon barrels	Year	42-gallon barrels
1945–49 (average)	377,000	1953	1,694,000
1950	735,000	1954	1,584,000
1951	1,020,000		
1952	1,279,000	1945–54 (total to date)	8,249,000

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REVIEW BY COUNTIES

The mineral industry of the State was centered mainly in the industrial area near Birmingham, in Jefferson County, which supplied 66 percent of the total value of production in the State. Other leading counties were Blount, Marengo, Mobile, St. Clair, Shelby, Talladega, Tuscaloosa, and Walker.

In addition to the detailed descriptions of the mineral industries of the various counties listed below, the production of natural gas and petroleum is shown on a statewide basis only.

TABLE 18.—Value of mineral production in Alabama, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954, in order of value [2]
Baldwin	(3)	(3)	Miscellaneous clays, sand and gravel.
Barbour	(3)	(3)	Bauxite.
Bibb	$740,708	(3)	Iron ore, coal.
Blount	1,733,621	(3)	Coal, cement, fire clay, iron ore, sandstone.
Butler	404,011	$409,006	Iron ore.
Calhoun	673,841	416,502	Sandstone, sand and gravel, fire clay, miscellaneous clays.
Cherokee	(3)	(3)	Iron ore, sand and gravel.
Chilton	(3)	1,587	Mica, fire clay.
Clay	(3)	13,869	Mica, sand and gravel.
Colbert	(3)	(3)	Native asphalt, sand and gravel.
Coosa	(3)	(3)	Sand and gravel, mica.
Covington	18,271	15,000	Sand and gravel.
Crenshaw	(3)	(3)	Iron ore.
Cullman	248,471	(3)	Coal.
Dallas	(3)	544,594	Sand and gravel.
De Kalb	(3)	(3)	Limestone, sandstone.
Elmore	(3)	(3)	Sand and gravel, mica.
Escambia	(3)	(3)	Sand and gravel, miscellaneous clays.
Etowah	(3)	(3)	Limestone, sand and gravel.
Fayette	(3)	2,100	Miscellaneous clay.
Franklin	(3)	(3)	Iron ore, limestone, sand and gravel, fire clay.
Greene	29,537	(3)	Sand and gravel.
Houston	(3)	(3)	Iron ore, sand and gravel.
Jackson	131,224	(3)	Limestone, sandstone, coal.
Jefferson	132,168,705	99,317,680	Coal, iron ore, cement, lime, limestone, miscellaneous clays, sandstone, fire clay, sand and gravel.
Limestone	61,180	68,920	Limestone, sand and gravel.
Macon	(3)	106,669	Sand and gravel.
Madison	(3)	(3)	Limestone, miscellaneous clays.
Marengo	(3)	(3)	Cement, limestone.
Marion	(3)	(3)	Coal, kaolin, sand and gravel.
Marshall	(3)	15,000	Sand and gravel.
Mobile	(3)	(3)	Cement, miscellaneous clays, lime, sand and gravel.
Monroe	(3)	(3)	Sand and gravel.
Montgomery	(3)	(3)	Sand and gravel, miscellaneous clays, iron ore.
Morgan	(3)	(3)	Sand and gravel, limestone.
Pickens	3,599	(3)	Sand and gravel.
Pike	51,969	574,826	Iron ore.
Randolph	(3)	(3)	Mica.
Russell	(3)	(3)	Miscellaneous clays, sand and gravel.
St. Clair	(3)	(3)	Cement, limestone, coal, fire clay, miscellaneous clay.
Shelby	(3)	(3)	Lime, limestone, coal, iron ore, fire clay, miscellaneous clay.
Sumter		4,500	Sand and gravel.
Talladega	(3)	1,282,156	Marble, iron ore, sand and gravel, miscellaneous clay.
Tuscaloosa	3,813,242	(3)	Coal, sand and gravel.
Walker	15,703,580	11,027,604	Coal, fire clay.
Washington	(3)	(3)	Limestone, salt.
Winston	13,437	(3)	Coal.
Undistributed [4]	[5] 31,291,604	37,529,987	
Total Alabama	[5] 187,087,000	151,330,000	

[1] County figures exclude petroleum and natural gas. The following counties are not listed because no production was reported: Autauga, Bullock, Chambers, Choctaw, Clarke, Cleburne, Coffee, Conecuh, Dale, Geneva, Hale, Henry, Lamar, Lauderdale, Lawrence, Lee, Lowndes, Perry, Tallapoosa, and Wilcox.
[2] Other than petroleum and natural gas.
[3] Figure withheld to avoid disclosure of individual company operations; included with "Undistributed."
[4] Includes value for petroleum and natural gas.
[5] Revised figure.

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Baldwin.—Fairhope Clay Products Co. (Fairhope mine) mined miscellaneous clay for heavy clay products; production increased 12 percent. The Alabama State Highway Department mined a small quantity of paving sand.

Barbour.—The Aluminum Co. of America (Eufaula mine) and the D. M. Wilson Bauxite Co. (Hudson mine) mined crude bauxite for chemicals and refractories; production decreased 27 percent.

Bibb.—Coal production was 41,300 tons valued at $260,000, compared with 119,300 tons valued at $740,900 in 1953. Shook & Fletcher Supply Co. (Adkins mine) mined brown iron ore for sale to iron and steel plants.

Blount.—The Cheney Lime & Cement Co. produced pozzolan cement. The Lehigh Coal Co. (Trafford mine) and the Harbison-Walker Refractories Co. mined fire clay for firebrick and block and for heavy clay products; production was 34,000 tons valued at $118,000. Coal production was 174,900 tons valued at $1,171,800, compared with 168,300 tons valued at $1,113,000 in 1953. Shook & Fletcher Supply Co. (Taits Gap mine) mined brown iron ore for sale to iron and steel plants. J. R. House opened a new quarry and produced crushed sandstone for refractory purposes. A. O. Brown (Brown quarry) and J. R. House quarried dimension sandstone for rubble and rough architectural uses.

Butler.—The B. & R. Mining Co. (B. & R. mine), the Bridgewater Mining Co., the Crenshaw Mining Co. (Crenshaw mine), and the Greenville Mining Co. (Greenville mine) mined brown iron ore for sale to iron and steel plants.

TABLE 19.—Shipments of brown iron ore in Butler County, 1945–49 (average) and 1950–54

Year	Long tons	Value	Year	Long tons	Value
1945–49 (average)	762	$2,700	1952	2,749	$15,065
1950			1953	71,732	404,011
1951			1954	66,530	409,006

Calhoun.—The Donoho Foundry Co. (Anniston mine) mined fire clay for foundries and steelworks; production was 17,900 tons valued at $44,700. The Agricola Brick Co. (Piedmont mine) mined miscellaneous clay for heavy clay products; production was 24,300 tons valued at $24,000. John B. Lagarde, Inc., (Lagarde mine) mined paving sand; production declined 16 percent. Harbison-Walker Refractories Co. (Oxford quarry) produced crushed sandstone for refractory uses; production declined 50 percent.

Cherokee.—Baker & Howell (Pope mine) and the Margemma Mining Co (Laney Hollow mine) mined brown iron ore for sale to iron and steel plants. The Wolf Creek Sand Co. (Wolf Creek mine) mined molding sand; production was 5,700 tons valued at $11,600.

Chilton.—Norman E. Smith (Lawley mine) mined fire clay for art pottery and stoneware; production was 90 tons valued at $450. The Inlow Mica Co. (Inlow mine) mined scrap mica for grinding. Several operators produced a small quantity of sheet mica; total production declined 56 percent.

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Clay.—Dixie Mines, Inc. (Hurst mine), Lett & Starrett (Barfield mine), Smith Mica Co. (Fletcher-Smith mine), and James W. Starrett & Co. mined sheet mica. Dixie Mines, Inc., continued a DMEA project for sheet mica at the Hurst mine, and the Smith Mica Co. began DMEA project for sheet mica at the Fletcher-Smith mine. The Alabama State Highway Department mined 33,000 tons of paving sand valued at $5,000.

Colbert.—The Alabama Asphaltic Limestone Co. (Margerum quarry) produced native asphalt for road metal; production declined 59 percent. The Tennessee Valley Sand & Gravel Co. (Sheffield mine) mined structural and paving sand and gravel; production increased 24 percent.

Coosa.—The Norris Mica Co. (Ivy mine) mined a small quantity of sheet mica; production declined 6 percent. Town & Sons opened a new pit and produced glass, molding, and grinding sand.

Covington.—The Alabama State Highway Department mined 40,000 tons of paving sand valued at $15,000. This was the only reported production in the county.

Crenshaw.—The Arrington Mining Co. opened a new mine and produced brown iron ore for sale to iron and steel plants. This is the first iron-ore production reported from Crenshaw County.

Dallas.—C. Pierson Cosby (Cosby mine), the Dallas Sand & Gravel Co. (Dallas mine), and the Southeastern Sand & Gravel Co. mined engine, molding, railroad ballast, structural and paving sand, and railroad ballast, structural, paving, and other gravel; production was 694,200 tons valued at $544,600, compared with 570,900 tons valued at $389,600 in 1953.

De Kalb.—The Miller Limestone Co. opened a new quarry and produced crushed limestone for concrete and road metal and for agricultural use. The De Kalb Stone Co. opened a new quarry and quarried dimension sandstone for rubble and flagging.

Elmore.—The Norris Mica Co. mined a small quantity of sheet mica. The Alabama Gravel Co. and the Mortar Creek Materials Co. (Elmore mine) mined paving and other sand and railroad ballast, structural, paving and other gravel.

Escambia.—The Keego Clay Products Co. (Brewton mine) mined miscellaneous clay for heavy clay products; production was 11,500 tons valued at $11,400. The Alabama State Highway Department, the Dixie Sand & Gravel Co. (Dixie mine), the Flomaton Gravel Co. (Flomaton mine), and the Henderson Gravel Co. (No. 1 mine) mined structural and paving sand and structural, paving and other gravel; production was 126,900 tons.

Etowah.—The Alabama Aggregate Co. (Cobb City quarry) produced crushed limestone for riprap, flux, concrete, and road metal and for agricultural uses; production was 189,900 tons valued at $152,500, compared with 279,500 tons valued at $391,400 in 1953. The Milner Sand Co. (Milner mine) mined molding sand and structural and paving sand and gravel; production increased 40 percent.

Fayette.—The Columbus Brick Co. (Fayette mine) mined miscellaneous clay for heavy clay products; production increased 33 percent.

Franklin.—The Tennessee Valley Sand & Gravel Co. (Spruce Pine mine) mined fire clay for fire-clay mortar; production declined 16

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percent. R. S. Bowen (Bowen mine), A. G. Britton, Jack King, the Shook & Fletcher Supply Co. (Blackburn and Warner mines), United States Pipe & Foundry Co. (Belgreen and Russellville No. 14 mines), and Schroeder & Co. (Belgreen mine) mined brown iron ore for use in iron and steel plants; during the year the Belgreen mine was purchased by the United States Pipe & Foundry Co. from Schroeder & Co. The Alabama Limestone Co. (Rockwood quarry) produced crushed limestone for concrete and road metal, agriculture, whiting, asphalt and other filler, and rock dust for coal mines and for mineral food; production was 16,400 tons valued at $38,200. The Alabama Limestone Co. (Rockwood quarry) quarried dimension limestone for rubble, rough architectural, and sawed and cut dressed building stone; production was 18,300 tons valued at $802,700. The Tennessee Valley Sand & Gravel Co. (Spruce Pine mine) mined structural and paving sand and gravel.

Greene.—The Bigbee Block & Gravel Co. (Gainsville mine) mined structural and paving sand and gravel.

Houston.—Price & Jackson opened a new mine and produced brown iron ore for sale to iron and steel plants. The L. C. Smith Sand & Gravel Co. (Dothan mine) mined structural and paving sand; production declined 61 percent.

Jackson.—Coal production was 3,300 tons valued at $21,600. The Alabama State Highway Department (Jackson quarry) produced crushed limestone for concrete and road metal; production was 47,400 tons valued at $59,000, compared with 106,100 tons valued at $131,200 in 1953. The Jackson County Highway Department opened a new quarry and produced crushed sandstone for concrete and road metal.

Jefferson.—The Alpha Portland Cement Co. (Phoenixville mill), the Lehigh Portland Cement Co. (Birmingham mill), the Lone Star Cement Co. (Birmingham mill), and the Universal Atlas Cement Co. (Leeds mill) produced portland cement; production exceeded that of any previous year. Pozzolan cement was produced at the North Birmingham plant of the Southern Cement Co. The Bibby Coal, Shale & Clay Co. (Bibby mine), the Dixie Fire Brick Co., Inc. (Warrior mine), and J. E. Moore mined fire clay for firebrick, fire-clay mortar, and foundries and steelworks; production declined 32 percent. The 1954 figures for miscellaneous clay include clay used in cement manufacture. The Alpha Portland Cement Co., the Birmingham Clay Products Co., the Lehigh Portland Cement Co., the Lone Star Cement Corp., the Natco Corp. (Bessemer mine), the Stephenson Brick Co. (Lovick mine), the Universal Atlas Cement Co., and the Watkins Brick Co. (Ensley mine) mined miscellaneous clays for cement and heavy clay products.

TABLE 20.—Portland cement shipments in Jefferson County, 1948–49 (average) and 1950–54

Year	376-pound barrels	Value	Year	376-pound barrels	Value
1948–49 (average)	5,844,347	$12,146,130	1952	6,289,918	$15,007,623
1950	6,354,579	13,941,900	1953	6,090,801	15,255,438
1951	6,229,623	14,845,395	1954	6,577,320	16,865,621

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TABLE 21.—Miscellaneous clay sold or used by producers in Jefferson County, 1948–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1948–49 (average) [1]	159,049	$130,377	1952 [1]	111,373	$207,995
1950 [1]	142,238	125,276	1953 [1]	87,508	87,508
1951 [1]	149,365	140,163	1954	285,255	(2)

[1] Except clay for cement.
[2] Figure withheld to avoid disclosure of individual company operations.

Coal production was 6,981,000 tons valued at $47,635,000, compared with 8,691,000 tons valued at $56,234,000 in 1953. The Republic Steel Corp. (Edwards and Spaulding mines), the Southeastern Coal & Iron Co., The Tennessee Coal & Iron Division of the United States Steel Corp. (Muscoda and Wenonah mines), the United States Pipe & Foundry Co. (Sloss Red Ore mine), and the Woodward Iron Co. (Pyne, Songo and Woodward Red Ore mines) mined red iron ore (hematite) for use in iron and steel plants. Shipments were 4,938,000 long tons valued at $28,333,000, compared with 6,714,000 long tons valued at $51,720,000 in 1953. Of the total shipments, concentrate was 1,146,000 long tons valued at $7,580,000, direct shipping ore was 3,186,000 long tons valued at $17,304,000, and sinter was 606,200 long tons valued at $3,449,000. The Tennessee Coal & Iron Division of United States Steel Corp. (Ensley Works) produced lime for refractory, chemical, and industrial uses; production declined 31 percent. Sam P. Acton mined molding and other sand. The 1954 figures for crushed limestone include limestone used in cement and lime. The Alpha Portland Cement Corp., the Dolcito Quarry Co., the Lehigh Portland Cement Co., the Lone Star Cement Corp., the Tennessee Coal & Iron Division of the United States Steel Corp. (Dolonah quarry and No. 5 Limestone mine), the Universal Atlas Cement Co., and the United States Pipe & Foundry Co. (Sloss North Birmingham quarry) produced crushed limestone for cement and lime, flux, concrete and road metal, agriculture, and rock dust for coal mines as well as for refractory uses; production was 3,859,000 tons valued at $5,147,000. Enos E. Vann produced crushed sandstone for concrete and road metal and for use in foundries. The Sand Valley Stone Co. quarried dimension sandstone for dressed building stone.

Limestone.—The Limestone County Board of Revenue (county quarry) produced crushed limestone for riprap and concrete and road metal; production was 40,300 tons valued at $56,400, compared with 17,200 tons valued at $24,100 in 1953. The Limestone County Board of Revenue (Athens mine) mined paving gravel; production was 168,800 tons valued at $12,500, compared with 71,000 tons valued at $37,100 in 1953.

Macon.—The Creek Sand & Gravel Co., the Macon County Sand & Gravel Co. (Tuskagee mine), the Sharpe Sand & Gravel Co., and the Valley Gravel Co. (Franklin mine) mined structural and paving sand and gravel; production was 107,800 tons valued at $106,700.

Madison.—The Alabama Brick & Tile Co. (Farley mine) and the Huntsville Brick & Tile Co. (Huntsville mine) mined miscellaneous clay for heavy clay products; production declined 28 percent. The Madison Limestone Co. (Madison quarry) produced crushed lime-

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stone for concrete and road metal and agricultural use; production was 218,000 tons valued at $244,200, compared with 195,000 tons valued at $252,900 in 1953.

Marengo.—The Lone Star Cement Co. (Spocari mill) produced portland cement; shipments declined 12 percent. The Lone Star Cement Co. produced crushed limestone for use in cement.

Marion.—The Thomas Alabama Kaolin Co. (Hackelburg mine) mined kaolin for firebrick and block and for paint, paper, and other filler; production declined 14 percent. Coal production was 277,000 tons valued at $1,407,000, compared with 253,500 tons valued at $2,192,700 in 1953. Thompson & Rowell (Guin mine) mined structural and paving sand and gravel; production was 2,500 tons valued at $2,800.

Marshall.—The Alabama State Highway Department mined paving sand; production was 15,000 tons valued at $15,000.

Mobile.—The Ideal Cement Co. (Mobile mill) produced portland cement, and mined miscellaneous clay for cement. The Ideal Cement Co. (Mobile limekiln) produced lime for chemical and industrial uses. The Southern States Sand & Gravel Co. (Mobile mine) mined structural sand.

Monroe.—Mannings Sand & Gravel Co. mined structural sand and gravel.

Montgomery.—The Excelsior Brick Co. (Montgomery mine) and the Jenkins Brick Co. mined miscellaneous clay for heavy clay products; production was 152,700 tons valued at $151,200. Harrison & Adams mined a small quantity of brown iron ore for sale to iron and steel plants. The Birmingham Slag Co. (No. 1 mine), the City of Montgomery (City mine), the City Sand & Gravel Co., Inc. (Montgomery mine), the Haigler Materials Co. (Haigler mine), the Montgomery County Highway Department (county mine), the Montgomery-Roquemore Gravel Co. (No. 2 mine), and the Vandigriff Construction Co. (Vandigriff mine) mined engine, structural, and paving sand and structural, paving, and railroad-ballast gravel; production declined 17 percent.

Morgan.—The Trinity Stone Co. (Trinity quarry) produced crushed limestone for concrete and road metal; production was 95,200 tons valued at $119,100. The Decatur Sand & Gravel Co. (Decatur mine) mined structural and paving sand and gravel; production increased 35 percent.

Pickens.—The Powell Gravel Co. (Powell mine) mined structural and paving sand and gravel.

Pike.—The Arrington Mining Co. (Pike County mine), the Bibb Co. (Bibb mine), the Big Creek Mining Co. (Big Creek mine), and the Glenwood Mining Co. (Glenwood mine) mined brown iron ore for sale to iron and steel plants; shipments were 117,800 long tons valued at $574,800, compared with 10,700 long tons valued at $52,000 in 1953.

Randolph.—Bourne Associates (Friendship No. 2 mine), H. W. Saunders (Indian, Ogle, Trammel and Virge mines), J. J. New (New mine), and Raymond Rendelman (Hurst mine) mined sheet mica; production was considerably more than in 1953. C. E. Smith conducted a DMEA project for sheet mica at the Pate mine, and Francis

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C. Bourne started a DMEA project for sheet mica at the Liberty mine.

Russell.—The Bickerstaff Co., Inc. (Ceramic mine), the Bickerstaff Brick Co. (Brickyard mine), and the Dixie Brick Co. mined miscellaneous clay for heavy clay products; production increased 43 percent. The Consolidated Gravel Co., Inc. (Dixieland mine), and the Jones Sand & Gravel Co. (Kendricks mine) mined paving sand.

St. Clair.—The National Cement Co. (Ragland mill) produced portland cement and produced crushed limestone for cement. The Riverside Clay Co. (Riverside mine) mined fire clay for foundries and steelworks; production was 11,700 tons valued at $15,300. The National Cement Co. and the Ragland Brick Co. (Ragland mine) mined miscellaneous clay for cement and heavy clay products. Coal production was reported.

Shelby.—The Southern Cement Co. (Calera mill) produced portland cement. The Montevallo Clay Co. (Montevallo mine) mined fire clay for foundries and steelworks; production was 12,400 tons valued at $35,700, compared with 12,500 tons valued at $16,100 in 1953. The Southern Cement Co. mined miscellaneous clay for use in cement. Coal production was 77,200 tons valued at $474,000, compared with 87,900 tons valued at $608,900 in 1953. The Shelby Sand & Ore Co. (Shelby mine) mined brown iron ore for sale to iron and steel plants. The Alabaster Lime Co. (Scotrock limekiln), the Cheney Lime & Cement Co. (Landmark limekiln), the Dixie Lime & Manufacturing Co. (Pelham limekiln), the Keystone Lime Works (Keystone limekiln), the Longview Lime Corp. (Saginaw limekiln), and the Southern Cement Co. (Roberta limekiln) produced lime for building, agricultural, chemical, and industrial uses.

The Alabama Aggregates Co. (Pelham quarry), the Alabaster Lime Co. (Scotrock quarry), the Cheney Lime & Cement Co. (Landmark quarry), the Dixie Lime Mfg. Co., the Keystone Lime Works, the Longview Lime Corp. (Saginaw A quarry), the Montevallo Limestone Co., and the Southern Cement Co. produced crushed limestone for cement and lime manufacture and for riprap, flux, concrete and road metal, railroad ballast, agriculture, paper and asphalt filler, and rock dust for coal mines and for acid neutralizer; production was 1,202,000 tons valued at $1,617,000.

TABLE 22.—Lime sold or used by producers in Shelby County, 1948–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1948–49 (average) [1]	166,727	$1,628,717	1952 [1]	274,842	$2,914,493
1950 [1]	194,026	2,041,184	1953	303,303	3,281,875
1951 [1]	249,429	2,583,869	1954	287,912	3,125,013

[1] Sales only.

Sumter.—The Sumter County Highway Department (Livingston mine) mined paving gravel; production was 40,500 tons valued at $4,500.

Talladega.—The Milner Sand Co. mined miscellaneous clay for heavy clay products. The De Shor Mining Co. (De Shor mine)

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mined brown iron ore for sale to iron and steel plants. The Alabama Marble Co. (Alabama quarry), the Moretti-Hurrah Marble Co. (Moretti-Hurrah quarry), and Thompson-Weinman & Co. (Hill quarry) produced crushed marble for terrazzo and whiting; production increased 52 percent. The Alabama Marble Co. (Alabama quarry) and the Moretti-Hurrah Marble Co. (Moretti-Hurrah quarry) quarried dimension marble for interior rough building stone, sawed and cut interior dressed building stone, and cut dressed monumental stone; production declined 14 percent. The Alabama State Highway Department (Talladega County mine) mined paving sand; production was 24,900 tons valued at $19,400, compared with 32,200 tons valued at $18,300 in 1953.

Tuscaloosa.—Coal production was 621,600 tons valued at $2,666,600, compared with 581,300 tons valued at $2,761,000 in 1953. The Finnell Sand & Gravel Co. (Northport mine) and the Yazoo Gravel Co. Inc. (Yazoo mine), mined structural sand and structural, paving, and other gravel in 1954.

Walker.—The Harris Coal & Clay Co. (Cordova mine), the Natco Corp., the Russell Coal & Clay Co., and the Taft Coal & Clay Co. mined fire clay for firebrick and block, fire-clay mortar, and heavy clay products.

TABLE 23.—Fire clay sold or used by producers in Walker County, 1948–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1948–49 (average)	67,486	$137,483	1952	105,407	$500,194
1950	91,264	153,227	1953	126,492	330,779
1951	101,660	523,192	1954	141,190	714,604

Coal production was 2,083,500 tons valued at $10,313,000, compared with 2,579,000 tons valued at $15,373,000 in 1953.

Washington.—The Lone Star Cement Co. produced crushed limestone for use in its cement mill in Louisiana. The Mathieson Chemical Corp. produced salt from brine; production reached a new peak and increased 4 percent over 1953.

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The Mineral Industry of Alaska

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Department of Mines, Territory of Alaska.

By William H. Kerns [1] and Phil R. Holdsworth [2]

DESPITE a drop of over $2 million in the value of coal output, the total value of mineral production in Alaska in 1954 was $160,000 more than in 1953. The decrease in value of coal output was counterbalanced by an increase of over $1 million in the value of sand and gravel production, $200 thousand in chromite, and about $300 thousand each in mercury, stone, and tin.

The output of three commodities (listed in order of value of output—gold, coal, and sand and gravel) represented 88 percent of the total value of mineral production in Alaska in 1954. The output of platinum-group metals, which contributes a sizable sum to the value of mineral production in Alaska each year, was slightly increased over 1953. The production of chromite, the first from Alaska since 1944, added significantly to the overall total value of mineral production, as did the increased production of mercury, stone, and tin.

TABLE 1.—Mineral production in Alaska, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Chromite.....gross weight			2,953	$208,257
Coal (bituminous)	861,471	$8,451,542	666,618	6,442,414
Copper (recoverable content of ores, etc.)			[2] 4	2,478
Gold (recoverable content of ores, etc.).....troy ounces	253,783	8,882,405	248,511	8,697,885
Lead (recoverable content of ores, etc.)	9	2,240		
Mercury.....76-pound flasks	40	7,721	1,046	276,552
Sand and gravel	7,689,278	5,079,681	6,639,638	6,301,939
Silver (recoverable content of ores, etc.).....troy ounces	35,387	32,027	33,697	30,497
Stone	47,086	169,711	283,734	465,423
Tin (content of ore and concentrate).....long tons	49	105,917	199	409,953
Undistributed: Tungsten (1953), clays (1954), gem stones, platinum-group metals		1,520,782		1,576,380
Total Alaska		24,252,000		24,412,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Includes 3,300 pounds of copper recovered from ore shipped from an inactive mine in 1954; ore was mined before 1954.

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As indicated by the fact that the value of gold recovered in Alaska in 1954 was 36 percent of the total value of mineral production, gold mining was a large and important component of the mineral industry of Alaska. The yearly production in the 4-year period, 1951–54, has indicated a stabilization or leveling-off of production of gold to a fairly constant level with a difference of approximately $500 thousand between the low of $8,387 thousand in 1951 and the high of $8,882 thousand in 1953. Nearly all of the gold came from placer mines. Dredges recovered 79 percent of the total placer gold; 20 percent was recovered by the nonfloating-washing-plant type of operation, where power excavators and washing plants are both on dry land; the remaining 1 percent came from hydraulic, small-scale hand and underground (drift) mines.

Although some placer-gold-mining operations closed because of increased costs, other new operations virtually compensated for the lost production. Some operators reduced labor costs by forming working-partnership arrangements or by putting all members of the family to work and others were able to continue their operations by working only the higher-grade ground.

Worthy of mention among the minerals other than gold produced in Alaska was the output in 1954 of chromite, mercury, and tin from three lode mines. The Kenai Chrome Co. made its first shipment of chromite since 1944 from Star Four mine on Red Mountain near Seldovia in the Kenai Peninsula region. The DeCoursey Mountain Mining Co. recovered over 1,000 flasks of mercury from ore mined from the Red Devil mine near Sleitmute on the Kuskokwim River in Aniak district. The United States Tin Corp. recovered 199 long tons of tin from ore mined and milled at Lost River mine on Cassiterite Creek in the Seward Peninsula region.

TABLE 2.—Value of selected mineral commodities produced in Alaska, 1953–54 [1]

Commodity		Price	
		1953	1954
Clay [2]	short ton		$15.08
Coal [2]	do	$9.81	9.66
Copper [3]	pound	.287	.295
Gold [4]	troy ounce	35.00	35.00
Lead [3]	pound	.131	.137
Mercury [5]	76-pound flask	193.03	264.39
Sand and gravel [2]	short ton	.66	.95
Silver [6]	troy ounce	.905+	.905+
Stone [2]	short ton	3.60	1.64
Tin (Straits quality) [7]	pounds	.958	.918
Tungsten concentrate [8]	short-ton unit WO_3	63.00	63.00
Zinc [3]	pound	.115	.108

[1] Prices are discussed in detail in the commodity chapters in volume 1 of this series.
[2] Average unit price f. o. b. mine or quarry.
[3] Annual average weighted price of all grades of primary metal sold to producers.
[4] Price under authority of Gold Reserve Act of January 31, 1934.
[5] Annual average E&MJ Metal and Mineral Market quoted price at New York.
[6] Treasury buying price for newly mined silver.
[7] Annual average American Metal Market quoted price.
[8] Price paid by Government under terms of the Domestic Tungsten Program.

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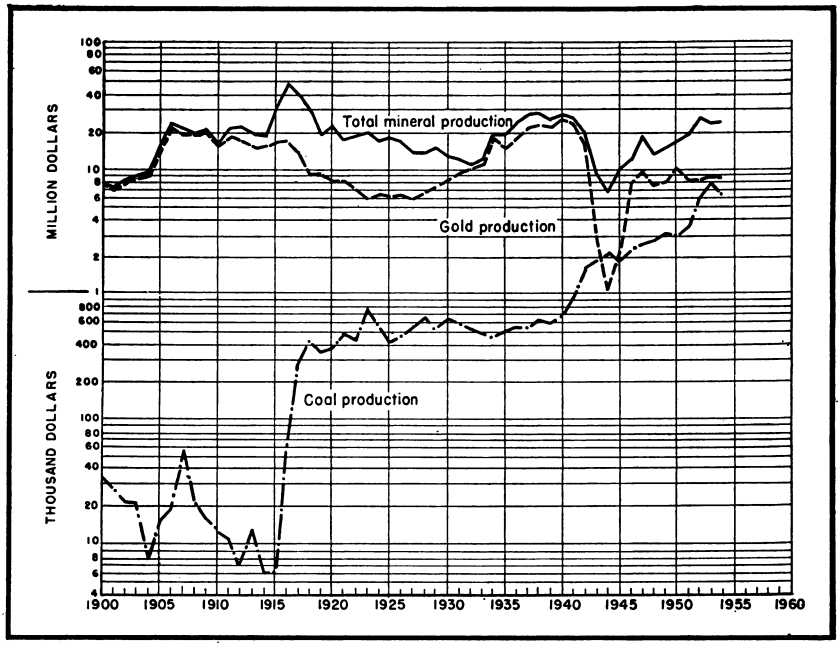

FIGURE 1.—Value of total mineral production, gold, and coal in Alaska, 1900-54. From 1911-31 copper production accounted for most of the value of minerals other than gold and coal.

Prospecting and Exploration.—Prospecting and exploration activities in Alaska in 1954 were greatly increased over 1953. While looking for uranium, prospectors covered the ground and kept a lookout for other minerals. Qualified prospectors were "grubstaked," or hired by groups of men to prospect and locate claims, and many mining companies sent their engineers to examine prospects. Particular attention was given to the search for copper and iron deposits in Southeastern Alaska. United States Steel Corp., W. S. Moore Co., and Northwest Ventures, Ltd., were active in the search for iron and copper deposits. Northern Pyrites Co., a subsidiary of Texas Gulf Sulphur Co., explored copper-iron sulfide deposits in the Prince William Sound area. Prospecting and exploration were continued on copper prospects in the Nizina district of Copper River region near the famous Kennecott mine.

Prospecting and exploration for oil in Alaska took on boom proportions in 1954. Reports were received that eight major oil companies, in addition to a number of smaller United States and Alaskan companies, were actually prospecting or exploring for oil in Alaska in 1954. Three companies conducted drilling projects. Applications for oil-land leases were made on nearly 4 million acres of Alaska land.

Government Financial Assistance.—Government assistance to the mineral industry through the Defense Minerals Exploration Administration (DMEA) and Defense Minerals Procurement Agency (DMPA) helped to stimulate development of strategic and critical minerals

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TABLE 3.—Defense Minerals Exploration Administration activities in Alaska, 1952–54

Region and contractor	Property	District and location	Commodity	Total contract amount [1]			Status of fieldwork and contract at close of 1954
				1952	1953	1954	
BRISTOL BAY							
Wren, Waskey, & Wolfe (partnership).	Red Top	Bristol Bay, Marsh Mountain.	Mercury (lode)	$25,614			Contract completed; ore shoot discovered.
COOK INLET-SUSITNA							
Alaska Copper Mines, Inc	Kathleen-Margaret.	Valdez Creek, MacLaren River.	Copper (lode)			$41,530	Surface trenching completed; drifting started; work recessed for winter.
COPPER RIVER							
Alaska Copper Corp	Fidalgo-Alaska	Prince William Sound, Fidalgo Bay.	do	112,548			Contract terminated: no discovery made.
KUSKOKWIM RIVER							
DeCoursey Mountain Mining Co	DeCoursey	Aniak, north of Crooked Creek.	Mercury (lode)		$81,000		Work recessed for winter; ore intersections were made.
Do	Red Devil	Aniak, west of Sleimute	do		88,349		Contract completed; important discoveries made that resulted in production of mercury.
A. L. Howard	Red Mountain	Goodnews Bay, Red Mountain.	Platinum (placer)		12,000		First phase of contract completed; platinum-bearing gravel was discovered.
SEWARD PENINSULA							
Alaska Copper Corp	Rocky Mountain	Nome, Rocky Mountain Creek.	Tungsten (lode)	41,000			Contract terminated; no discovery made.
Zenda Gold Mining Co	Cape Creek	Port Clarence, Cape Creek.	Tin (placer)	120,000	39,300		Contract completed; substantial reserves discovered.
United States Tin Corp	Lost River	Port Clarence, Cassiterite Creek.	Tin (lode)	226,000			Work completed; additional contract being negotiated.
Alaska Tin Corp	Ear Mountain	Port Clarence, Ear Mountain.	Tin (placer)		18,000		Contract completed; no discovery made.
SOUTHEASTERN ALASKA							
Admiralty-Alaska Gold Mining Co	Mertie Lode	Admiralty, Funter Bay	Nickel-copper (lode).	120,000			Crosscut being advanced as base for new drilling contract.
Pacific Northern Minerals Co	Riverside	Hyder, north of Hyder	Tungsten-lead-zinc (lode).			96,120	Preparatory work conducted before project was recessed for winter.
Tillicum Mining Co	Tillicum	Ketchikan, Caamano Point.	Antimony (lode)	24,695			Contract completed; large zone of low-grade ore indicated.
YUKON RIVER							
Alaska Metals Mining Co	Stepovich	Fairbanks, Gilmore Dome	Tungsten (lode)	179,234			Contract completed; discovery certified.
Do	Yellow Pup	do	do			6,200	Work continued.
Earl R. Pilgrim & Co	Stampede	Kantishna, Stampede Creek.	Antimony (lode)	62,000			Work continued; several ore intersections made.
I. W. & Sara Purkeypile	Tozimoran Creek	Melozitna, Tozimoran Creek.	Tin (placer)	18,000			Contract completed; no discovery made.
Total				929,091	238,649	143,850	

[1] Government participation was 90 percent of total contract for tin, nickel, and platinum; 75 percent for tungsten, mercury, and antimony; and 50 percent for copper.

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in Alaska in 1954. During 1954 DMEA authorized new contracts to a total value of $143,850 for the purpose of exploring for copper at the Kathleen-Margaret mine on MacLaren River in the Cook Inlet-Susitna region, for tungsten-lead-zinc at the Riverside mine near Hyder in the southeastern region, and for tungsten at the Yellow Pup mine near Fairbanks in the Yukon River region. This was in addition to work that was continued on other projects under DMEA contracts authorized during 1951–53. (See table 3 for a summary of DMEA activities in Alaska).

The United States Tin Corp. continued to operate on funds from a DMEA advance against production and a commercial loan which was guaranteed by General Services Administration (GSA). The Kenai Chrome Co. mined and shipped chromite ore on a GSA advance against production.

No Reconstruction Finance Corporation or Federal Small Business loans were made in Alaska during 1954.

Consumption and Markets.—The production of clay, coal, sand and gravel, and stone in Alaska in 1954 supplied the demand; none was imported or exported. Clay was used for manufacturing brick and tile, which were sold and used in the Anchorage area, where they were produced. Coal was used mostly for generating power, but also for heating and cooking purposes.

Chromite was bought by the General Services Administration for the National Stockpile. Mercury production was sold in the United States. Undoubtedly some of it came back to Alaska for use by placer-gold-mining operators and lode-gold-milling operators for amalgamation of the gold in sluice boxes and on the tables. Tin concentrate was shipped by steamship from Lost River on the Seward Peninsula, where it was produced, to Seattle, Wash., then transshipped by rail to Texas where it was treated to recover the tin. No metal-processing plants were operated in Alaska; all direct-smelting gold, silver, and copper ores and concentrate produced in Alaska were shipped to smelters in the United States. Producers of gold in the form of nuggets, dust, bars, and amalgam ("sponge") sold their product to banks and gold buyers in Alaska or shipped it directly to one of the United States mints. A small quantity of unrefined gold was used in nugget and dust form for the manufacture of nugget jewelry which was sold in Alaska. A small quantity of Alaska jade was cut, polished, set in jewelry (some with gold nuggets), and sold locally.

All cement used in Alaska in 1954 was imported from the United States. Cement sold for $2.80 a sack (94 pounds) retail in Juneau. The installation of bulk-cement-distribution facilities at Anchorage, Seward, and Fairbanks reduced the price in those areas.

Transportation.—Inadequate transportation facilities, with resultant high transportation costs to, from, and within the Territory, were significant deterrents to the exploration, development, and exploitation of the mineral resources of Alaska. Ocean and rail-transportation rates were among the highest in the world. The Alaska shipping trade has been unattractive to ship operators because it is seasonal; most oceanborne cargo to the Territory moves during the summer. Labor disputes, usually during the peak of the summer shipping season, have caused frequent ship tieups, making ocean shipping unreliable to mining operations, and costly to ship owners. Only 1 major American

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steamship company and 2 American barge-freight companies provided service to the Territory. Passenger service was discontinued by the American steamship company in October 1954. One could travel to Southeastern Alaska by water only by making reservations for passage 6 months to a year in advance with the 1 Canadian steamship company that continued to give passenger service during the summer tourist season. The Jones Act prohibits foreign companies from hauling freight from one American port to another; they may haul only from an American to a foreign port or vice versa.

The Alaska Railroad, Government owned and operated and the only railroad in the Territory, served the interior of Alaska on 530 miles of track from tidewater at Seward and Whittier to Fairbanks; most of the freight was incoming.

Although the highway system has been enlarged and improved each year, vast areas known to contain mineral deposits are not served. These areas receive all supplies and equipment by air freight. Facilities for air transportation of passengers and freight in Alaska also have been improved, particularly to those areas not otherwise served. Rates have been reduced by competition and by construction and enlargement of airfields to accommodate larger aircraft; nevertheless, transportation costs remain high.

Power.—Power rates for mining operations remained high because of the relatively high cost of fuel. Fuel costs were high mainly because of high transportation costs. Diesel oil was transported to mining operations in remote areas that are not served by ocean, rail, or highway transportation facilities by air or by "cat train" over the snow and ice during the winter.

The New York Alaska Gold Dredging Corp. used hydroelectric power supplemented by diesel-electric power to operate three gold dredges at Nyac in the Kuskokwim River region. It reported that hydroelectric power cost $0.01 per kilowatt-hour as compared with $0.05 per kilowatt-hour for diesel-electric power. The Fairbanks unit of the United States Smelting, Refining & Mining Co. used coal to generate electric power at a centralized power plant at Fairbanks for its 6 gold dredges and its stripping and pumping equipment; the Nome unit used diesel oil to generate electric power at its centralized power plant at Nome for its 2 gold dredges for its stripping and pumping equipment.

Employment.—The active mining season at many operations in Alaska was limited to 5 months or less (June through October) because of climatic conditions; 110 days constituted the actual mining season at some operations. Most of the skilled labor was imported from the United States because of the short season; round-trip costs of transportation in many instances were borne by the company or individual employer. The short season necessitated working the men as many or more overtime hours at premium pay as at regular pay. At most placer mines the men worked 12 hours a day and 7 days a week throughout the short mining season. The cost-of-living differential in Alaska ranged from 25 to 75 percent above the average United States costs; wages reflected the differential. To reduce labor costs, working partnerships were formed, and hired men were replaced by members of the operator's family.

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The number of men employed at placer mines, lode mines and mills, and coal mines in Alaska, 1945–49 (average) and 1950–54 are shown in table 4.

TABLE 4.—Employment and injuries at placer mines, lode mines, and mills, and coal mines, 1945–49 (average) and 1950–54 [1]

Industry and year	Number of men employed	Man-days worked	Man-hours worked [2]	Man-days lost due to non-fatal injuries	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Fatal	Nonfatal
Placer mines:								
1945-49 (average)	1,639	309,353	2,474,824	591	0.2	46	0.08	18.59
1950	1,722	343,974	2,751,792	656	------	38	------	13.81
1951	1,219	222,577	1,780,616	402	1	45	.56	25.27
1952	1,286	246,065	1,968,520	200	1	27	.51	13.72
1953	1,460	284,390	2,275,120	616	1	53	.44	23.30
1954	1,356	265,820	2,126,560	374	1	46	.47	21.63
Lode mines and mills:								
1945-49 (average)	328	75,131	601,048	200	.4	8	.67	13.31
1950	243	52,850	422,800	596	------	14	------	33.11
1951	202	33,035	264,280	10	------	1	------	3.78
1952	222	40,060	320,480	------	------	------	------	------
1953	270	34,490	275,920	98	1	12	3.62	43.49
1954	299	43,410	347,280	190	3	20	8.64	57.59
Coal mines:								
1945-49 (average)	302	81,678	653,424	984	1.2	60	2.30	91.82
1950	297	70,364	562,912	941	.1	63	1.78	111.91
1951	287	66,985	535,880	834	------	66	------	123.16
1952	404	85,438	683,504	904	------	88	------	128.75
1953	394	112,636	901,088	2,049	2	160	2.22	177.56
1954	345	81,049	648,392	1,048	1	71	1.54	109.50
Total:								
1945-49 (average)	2,269	466,162	3,729,296	1,775	1.8	114	.48	30.57
1950	2,262	467,188	3,737,504	2,193	1	115	.27	30.77
1951	1,708	322,597	2,580,776	1,246	1	112	.39	43.40
1952	1,912	371,563	2,972,504	1,104	1	115	.34	38.69
1953	2,124	431,516	3,452,128	2,763	4	225	1.16	65.18
1954	2,000	390,279	3,122,232	1,612	5	137	1.60	43.88

[1] Data from Territory of Alaska, Department of Mines; data not available for nonmetallic mining and quarrying.
[2] Calculated from man-days worked on basis of an 8-hour day.

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—Earl R. Pilgrim continued exploration work by diamond drilling and surface trenching at the Stampede mine in the Kantishna district throughout 1954. Assessment work to hold claims at five other antimony mines in Alaska was reported. Table 5 shows all data that are available for publication on production of antimony in Alaska in years before 1954.

Chromium.—The production (shipments) of chromite ore in Alaska in 1954 was the first recorded output since 1944. The Kenai Chrome Co. made its first shipment of chromite from the Star Four mine on Red Mountain near Seldovia on the Kenai Peninsula in October 1954, after the 1953 and most of the 1954 mining seasons were spent constructing a camp, road, ore bin, dock, and ore-loading facilities. The 3,000 long tons (gross weight) shipment of chromite ore was a part of 13,000 tons the GSA had contracted to buy from the company.

The Seldovia Chrome Co., Inc., made a small test shipment of chromite ore in 1954 from the Chrome Maverick group of claims in the Fish Creek area near the Kenai Chrome Co. property.

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TABLE 5.—Production of antimony, 1943–54

Year	Ore and concentrate (shipments)		Year	Ore and concentrate (shipments)	
	Gross weight (short tons)	Content (short tons)		Gross weight (short tons)	Content (short tons)
1943 [1]	405	184	1949	74	44
1944	73	35	1950		
1945–46			1951	301	147
1947	40	26	1952	420	210
1948	68	44	1953–54		

[1] Figures before 1943 not available for publication.

Copper.—Copper minerals are distributed widely throughout most of the length and breadth of Alaska. Copper has been mined extensively from deposits in the Ketchikan district in Southeastern Alaska and from Prince William Sound and Nizina districts of the Copper River region. The fabulous copper bonanza at the Kennecott mine has had world renown. Copper has been important to the mineral industry of Alaska in the past and might be very important to its future. Alaska copper production from 1915 to 1927 did not fall below 23,000 short tons a year, with a value of more than $7 million a year; in 1916 it reached a peak of almost 60,000 short tons valued at more than $29 million.

With the past history of copper mining in Alaska in mind, production in 1954, although small, was significant. It came from three sources—a test shipment of copper ore from the Kathleen-Margaret mine in the Valdez Creek district by Alaska Copper Mines, Inc.; a shipment of gold flotation concentrate, which was recovered by Renshaw & Brown from ore mined from the Gold Cord mine in Willow Creek district; and from copper ore mined in years before 1954 from the Rich Hill mine in the Ketchikan district and during 1954 was hauled to the United States as ballast by the owner of the mine and boat.

Prospecting and exploration for copper in Alaska in 1954 were greater than in 1953. Exploration work conducted on the Kathleen-Margaret by Alaska Copper Mines, Inc., stimulated the prospecting and search for other copper prospects in the area, which was opened by this new discovery and by the building of Denali Highway through a remote area where little prospecting for copper had been done.

Exploration work begun in 1953 by Granduc Mines, Ltd., a partnership between Newmont Mining Corp. and Granby Consolidated Mining, Smelting & Power Co., Ltd., at the head of the Leduc River in northwestern British Columbia, 4 miles from the Alaska-British Columbia boundary line, was continued throughout 1954. It was reported that a large, low-grade copper-ore deposit was developed. Some prospecting was done on claims that were located on copper prospects on the American side of the border on the Leduc River.

Prospecting and exploration work was continued on copper prospects by Henry Schultz in the Nizina district, Copper River region; by Rhinehart Berg in the Shungnak district, Northwestern Alaska

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region; and by the Peninsula Exploration Co. on Sitkalidak Island in the Kodiak district, Kodiak region.

Gold.—The value of gold output represented 36 percent of the total value of mineral production in Alaska in 1954. In terms of value of output among the Territory mineral commodities, gold ranked first; the value of gold output exceeded by over $2 million the value of the second-ranking commodity, coal. Gold production decreased 2 percent—$184,000 below the 1953 output.

Despite ever-increasing costs for taxes, equipment, supplies, and labor Alaska gold output has remained remarkably stable in post-World War II years. Output in 1954 was 2 percent below that in 1953. The placer-gold mines that used mechanical excavating equipment, bulldozers, draglines, and sluice boxes (nonfloat) had an advantage in that very few men are required. For this type of operation in Alaska the entire labor-force requirement was 2 or 3 partners, or members of the family, and 1 or 2 hired men.

Gold produced before 1954, sold in 1954, and credited to 1954 production composed slightly over 1 percent of the recorded production. "Natural gold" reported as sold in the "open market" was less than 0.5 percent of the recorded production. All gold sold in its "natural state" (nuggets, grains, and dust that had not been melted or amalgamated) was sold to buyers and jewelers to be used in the manufacture of "nugget" jewelry. The prices reported as received for crude gold in nugget form ranged from $28 to $33 an ounce, which was $3 to $5 an ounce above the price that would have been received from the mint.

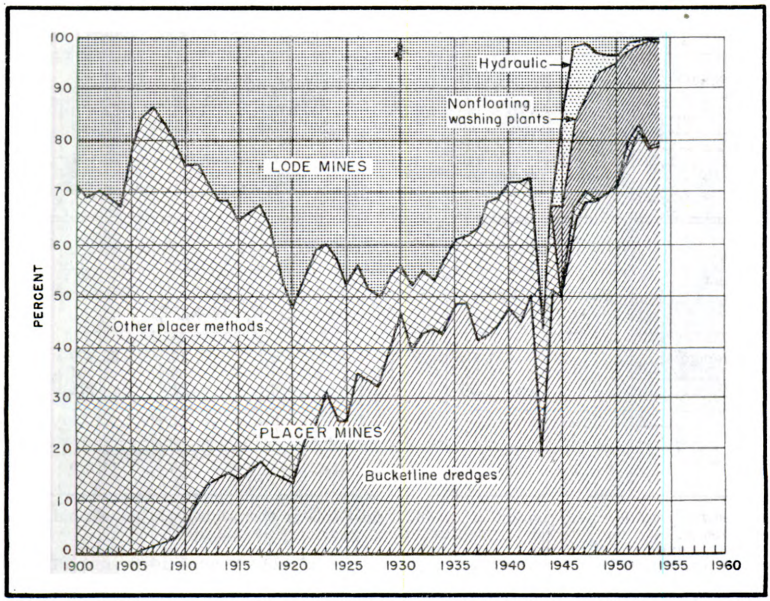

FIGURE 2.—Percentage of total Alaska gold produced at lode and placer mines and by various methods of placer mining, 1900–54; "other placer methods" includes hydraulic and nonfloating washing plants for which separate data are not available before 1943.

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The 146 producing placer mines in Alaska in 1954 (2 less than in 1953) produced 99.6 percent of the total gold output; the remainder of the gold came from 5 active lode mines (2 more than in 1953). The value ($8.7 million) of 1954 gold output (lode and placer) brought the accumulated value of the gold output in Alaska from the first production in 1880 through 1954 to over $698 million.

The 5 leading producers of gold in 1954 (the top 4 used floating bucketline dredges, and the fifth used a "dryland dredge") supplied 74 percent (72 percent in 1953) of the Alaska total gold output. Over 85 percent of the total (84 percent in 1953) came from 15 leading gold producers (all placer mines).

The number of companies or individuals that operated bucketline dredges (14) was the same in 1954 as in 1953 and 1952; however, the dredges in operation in Alaska in 1954 increased to 24 from 23 for the 3 previous years. They recovered 79 percent of the total placer output in 1954 (78 percent in 1953). Compared with 21 percent in 1953, 20 percent of the placer gold was recovered by the nonfloating-washing-plant type of operation, where power excavators and washing plants are both used on dry land. The remaining 1 percent of placer-gold output came from 17 hydraulic, 29 small-scale hand, and 1 underground (drift) mines.

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc, 1945–49 (average), 1950–54, and total 1880–1954, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945–49 (average)	19	231	23,211	210,539	$7,368,879	44,265	$38,863
1950	11	216	58,668	289,272	10,124,520	52,638	47,640
1951	6	140	13,870	239,637	8,387,295	32,870	29,749
1952	6	119	11,459	240,557	8,419,495	32,986	29,854
1953	3	148	[3] 475	253,783	8,882,405	35,387	32,027
1954	5	146	19,747	[4] 248,511	8,697,885	[4] 33,697	30,497
1880–1954			([5])	28,185,661	698,530,191	20,126,526	14,401,264

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	8	$3,112	154	$47,378	10	$2,479	$7,460,711
1950	6	2,496	149	40,230	6	1,704	10,216,590
1951	1	387	21	7,266	1	218	8,424,915
1952			1	386			8,449,735
1953			9	2,240			8,916,672
1954	[4] 4	2,478					8,730,860
1880–1954	685,909	226,889,239	25,751	3,028,700	56	14,320	942,863,714

[1] Includes recoverable metal content of gravel washed (placer operations); ore milled; old tailings or slimes re-treated; and ore shipped to smelters during calendar year indicated.
[2] Does not include gravel washed.
[3] Excludes ore reported in prior years from which 223 ounces of gold, 124 ounces of silver, and 1 ton of lead were produced from mill cleanup and concentrates from inactive properties.
[4] Includes 80 ounces of gold, 30 ounces of silver, and 3,300 pounds of copper recovered from mill cleanup at 3 inactive lode properties; ore was mined before 1954.
[5] Data not available.

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TABLE 7.—Fifteen leading gold-producing mines in 1954, in order of output

Rank	Mine	District	Region	Rank in 1953	Operator	Source of gold
1	Fairbanks unit	Fairbanks	Yukon River	1	United States Smelting, Refining & Mining Co	Dredge.
2	New York-Alaska	Aniak	Kuskokwim River	3	New York-Alaska Gold Dredging Corp	Do.
3	Nome unit	Nome	Seward Peninsula	2	United States Smelting, Refining & Mining Co	Do.
4	Coal Creek	Circle	Yukon River	(1)	Gold Placers, Inc	Do.
5	Collinsville	Yentna	Cook Inlet-Susitna	7	Collinsville Mine	Nonfloat.
6	Inmachuk River	Fairhaven	Seward Peninsula	6	Casa de Paga Gold Co	Dredge.
7	Colorado Creek	Innoko	Yukon River	11	Strandberg & Sons	Nonfloat.
8	Indian River	Hughes	do	9	do	Do.
9	Solomon River	Nome	Seward Peninsula	12	Lee Brothers Dredging Co	Dredge.
10	Discovery claim on Otter Creek	Iditarod	Yukon River	10	Miscovich Bros	Nonfloat.
11	Mohawk Association on Otter Creek	do	do	13	North American Dredging Co	Dredge.
12	Ganes Creek	Innoko	do	(2)	Ophir Mining Co	Do.
13	Fairbanks Creek	Fairbanks	do	14	Alder Creek Mining Co	Nonfloat.
14	Yankee Creek	Innoko	do	15	Rosander & Reed	Do.
15	Mastadon Creek	Circle	do	(2)	P. R. & H. Mining Co	Do.

[1] Did not produce in 1953. [2] Not among the fifteen highest in 1953.

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TABLE 8.—Gold produced at placer mines, 1945–49 (average), 1950–54, and total 1880–1954, by classes of mines and methods of recovery

Class and method	Mines producing [1]	Washing plants	Material treated (cubic yards)	Gold recovered		
				Fine ounces	Value	Average value per cubic yard
Surface placers:						
Gravel mechanically handled:						
Bucketline dredges:						
1945–49 (average)	19	25	9,456,000	140,211	$4,907,371	$0.519
1950	20	28	12,557,000	205,641	7,197,435	.573
1951	15	23	14,560,000	187,216	6,552,560	.450
1952	14	23	13,470,000	198,524	6,948,340	.516
1953	14	23	14,080,000	197,701	6,919,535	.491
1954	14	24	11,936,100	196,028	6,860,980	.575
Dragline dredges:						
1945–49 (average)	1	1	44,440	1,495	52,311	1.177
1950–54						
Nonfloating washing plants: [2]						
1945–49 (average)	78	78	2,615,300	41,183	1,441,391	.551
1950	116	116	4,908,500	68,199	2,386,965	.486
1951	84	84	2,667,000	47,244	1,653,540	.620
1952	78	78	2,137,000	39,661	1,388,135	.650
1953	87	87	3,591,000	53,991	1,889,685	.526
1954	85	85	2,866,300	48,880	1,710,800	.597
Gravel hydraulically handled:						
1945–49 (average)	85	------	1,364,900	19,928	697,494	.511
1950	24	------	135,300	2,097	73,395	.542
1951	17	------	166,500	2,798	97,930	.588
1952	9	------	39,000	660	23,100	.592
1953	14	------	36,000	820	28,700	.797
1954	17	------	97,400	1,481	51,835	.532
Small-scale hand methods (Wet):						
1945–49 (average)	46	------	37,366	826	28,917	.774
1950	50	------	18,000	905	31,675	1.760
1951	20	------	17,000	1,026	35,910	2.112
1952	17	------	16,400	422	14,770	.901
1953	33	------	17,000	604	21,140	1.244
1954	29	------	30,400	1,106	38,710	1.273
Underground placers (drift):						
1945–49 (average)	2	------	594	108	3,766	6.340
1950	6	------	2,200	269	9,415	4.280
1951	4	------	500	243	8,505	17.010
1952	1	------	600	23	805	1.342
1953						
1954	1	------	200	14	490	2.450
Grand total placers:						
1945–49 (average)	231	------	13,518,600	203,751	7,131,250	.528
1950	216	------	17,621,000	277,111	9,698,885	.550
1951	140	------	17,411,000	238,527	8,348,445	.479
1952	119	------	15,663,000	239,290	8,375,150	.535
1953	148	------	17,724,000	253,116	8,859,060	.500
1954	146	------	14,930,400	247,509	8,662,815	.580
1880–1954	------	------	[3]	[3]	[4] 480,640,682	[3]

[1] Excludes itinerant prospectors, "snipers", "high-graders", and others who gave no evidence of legal right to property.
[2] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dryland dredge."
[3] Data not available.
[4] Data for 1880 through 1936 from published records of the Federal Geological Survey.

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TABLE 9.—Mine production of gold, silver, and copper in 1954, by months, in terms of recoverable metals [1]

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)
January	456	77	----
February	778	119	----
March	518	65	----
April	3,476	529	----
May	13,564	1,890	----
June	38,110	5,100	----
July	30,687	4,079	----
August	41,468	5,550	----
September	42,348	5,836	----
October	35,836	4,991	4
November	21,470	2,839	----
December	19,800	2,622	----
Total	248,511	33,697	4

[1] Derived mostly from mine and smelter receipts; data are adjusted to exclude receipts during the first part of 1954 previously credited to 1953 production and to include expected receipts in 1955, which are part of actual output in 1954. No lead or zinc produced in 1954.

TABLE 10.—Mine production of gold, silver, and copper in 1954, by regions, in terms of recoverable metals [1]

Region	Mines producing		Gold (lode and placer)		Silver (lode and placer)		Total value
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	
Cook Inlet-Susitna	2	11	5,688	$199,080	918	$831	[2] $201,415
Copper River	----	6	254	8,890	38	34	8,924
Kenai Peninsula	1	1	223	7,805	65	59	7,864
Kuskokwim River	----	6	20,564	719,740	1,717	1,554	721,294
Northwestern Alaska and Seward Peninsula [3]	----	37	31,082	1,087,870	3,580	3,240	1,091,110
Southeastern Alaska [4]	1	----	492	17,220	112	101	[2] 18,295
Yukon River	1	85	190,208	6,657,280	27,267	24,678	6,681,958
Total	5	146	248,511	8,697,885	33,697	30,497	[2] 8,730,860

[1] No lead or zinc produced in 1954.
[2] Includes value of copper as follows: $1,504 (5,100 pounds), Cook Inlet-Susitna region; $974 (3,300 pounds), Southeastern Alaska region.
[3] Combined to avoid disclosing data of 1 operation in Northwestern Alaska region.
[4] Includes recovery in 1954 from mill cleanup at 1 inactive property and from ore shipped from 2 inactive properties.

In 1954 gold in ores from lode mines was recovered from a copper-ore shipment from the Kathleen-Margaret mine and from gold-ore mines at the Gold Cord mine in the Cook Inlet-Susitna region; from gold ore mined at the East Point mine in the Kenai Peninsula region; from a mill cleanup at the Chichagof mine, from re-treatment of Alaska-Juneau tailing, from copper-ore shipment from the Rich Hill mine, from gold ore from Miller Ledge & Lode mine in the Southeastern Alaska region; and from gold-ore mines at the Greenback claims in the Yukon River region.

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TABLE 11.—Mine production of gold, silver, and copper in 1954, by classes of ore or other source materials, in terms of recoverable metals [1]

Source	Number of mines	Material sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)
Lode ore:					
Dry gold	3	956	[2] 587	[2] 111	100
Copper	1	26	[3] 3	[3] 36	[3] 8,300
Other "lode" material: old tailings [4]	1	18,765	412	82	
Total "lode" material	5	19,747	[2 3] 1,002	[2 3] 229	[3] 8,400
Gravel (placer operations)	146	([5])	247,509	33,468	
Total, all sources	151	19,747	[2 3] 248,511	[2 3] 33,697	[3] 8,400

[1] No lead or zinc produced in 1954.
[2] Includes 76 ounces of gold and 16 ounces of silver recovered from a mill cleanup at an inactive mine in 1954 (ore was reported in years before 1954) and 2 ounces of gold and 1 ounce of silver recovered from 2 tons of ore shipped from an inactive property in 1954 (ore was mined in years before 1954).
[3] Includes 2 ounces of gold, 13 ounces of silver, and 3,300 pounds of copper recovered from 11 tons of ore shipped from an inactive property in 1954 (ore was mined before 1954).
[4] Dry gold.
[5] 14,930,400 cubic yards.

TABLE 12.—Mine production of gold, silver, and copper in 1954, by types of material processed and methods of recovery, in terms of recoverable metals [1]

Type of material processed and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)
Lode:			
Amalgamation:			
Ore	[2] 559	[2] 109	
Old tailings	412	82	
Concentration and smelting of concentrates: Ore	26	1	100
Direct smelting: Ore	[3] 5	[3] 37	[3] 8,300
Total	1,002	229	8,400
Placer	247,509	33,468	
Grand total	[2 3] 248,511	[2 3] 33,697	[3] 8,400

[1] No lead or zinc produced in 1954.
[2] Includes 76 ounces of gold and 16 ounces of silver recovered from a mill cleanup at an inactive mine in 1954 (ore was mined before 1954).
[3] Includes 4 ounces of gold, 14 ounces of silver, and 3,300 pounds of copper recovered from 13 tons of ore shipped from 2 inactive mines in 1954 (ore was mined before 1954).

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TABLE 13.—Mine production of gold, silver, and copper in 1954, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals [1]

A. For material treated at mills

BY REGIONS

	Material treated (short tons)	Recoverable in bullion		Concentrate shipped to smelters [2] and recoverable metal				
		Gold (fine ounces)	Silver (fine ounces)	Concentrate (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Cook Inlet-Susitna	240	130	5	6	26	1	100	
Kenai Peninsula	520	209	62					
Southeastern Alaska	18,765	[3] 488	[3] 98					
Yukon River	194	144	26					
Total: 1954	19,719	[3] 971	[3] 191	6	26	1	100	
1953	440	437	69	32	204	121		1,100
BY CLASSES OF MATERIAL TREATED								
Dry gold:								
Ore	954	[3] 559	[3] 109	6	26	1	100	
Old tailings	18,765	412	82					
Total: 1954	19,719	[3] 971	[3] 191	6	26	1	100	
BY CLASSES OF CONCENTRATE SHIPPED TO SMELTERS [2]								
Dry gold: 1954				6	26	1	100	
1953				32	204	121		1,100

B. For ore shipped directly to smelters

BY REGIONS

	Recoverable metal content				
	Ore shipped (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Cook Inlet-Susitna	15	1	23	5,000	
Southeastern Alaska	13	[4] 4	[4] 14	[4] 3,300	
Total: 1954	28	[5] 5	[5] 37	[5] 8,300	
1953	35	26	811		16,000
BY CLASSES OF MATERIAL					
Dry gold: Ore	2	[6] 2	[6] 1		
Copper: Ore	26	[7] 3	[7] 36	[7] 8,300	
Total: 1954	28	[8] 5	[8] 37	[8] 8,300	

[1] No lead was produced in 1954; no zinc was produced in 1953 or 1954.
[2] Excludes concentrate treated only by amalgamation and/or cyanidation.
[3] Includes 76 ounces of gold and 16 ounces of silver recovered from a mill cleanup at an inactive mine in 1954 (ore was mined before 1954).
[4] Gold and silver recovered from ore shipped from two inactive properties and copper recovered from ore shipped from one inactive property in 1954 (ore was mined before 1954).
[5] Includes quantities of gold, silver, and copper indicated by footnote 4.
[6] Recovered from ore shipped from an inactive property in 1954 (ore was mined before 1954).
[7] Includes 2 ounces of gold, 13 ounces of silver, and 3,300 pounds of copper recovered from 11 tons of ore shipped from an inactive property in 1954 (ore was mined before 1954).
[8] Includes quantities of gold, silver, and copper indicated by footnotes 6 and 7.

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TABLE 14.—Mine production of gold, silver, copper, and lead in 1954, by methods of recovery (except placer) and classes of material processed, in terms of gross metal content [1]

CONCENTRATE SHIPPED TO SMELTERS

Class of materia	Quantity shipped or treated (short tons)	Gross metal content			
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Dry gold: 1954	6	26	1	103	
1953	32	294	121		2,025

ORE SHIPPED DIRECTLY TO SMELTERS

Dry gold	2	[2] 2	[2] 1		
Copper	26	[2] 3	[2] 36	[2] 8,557	
Total: 1954	28	5	37	8,557	
1953	35	26	811		17,447

[1] No zinc produced in 1953 or 1954.
[2] From ore shipped from an inactive mine in 1954; ore was mined before 1954.
[3] Includes 2 ounces of gold, 13 ounces of silver, and 3,402 pounds of copper from 11 tons of ore shipped from an inactive mine in 1954; ore was mined before 1954.

Iron.—The known iron-ore occurrences in Alaska are chiefly in Southeastern Alaska, where scouting and exploration work has been concentrated; however, iron is a potential byproduct from the massive copper-iron sulfide deposits, which were being explored in the Prince William Sound area.

Two distinct types of iron ore are found in Southeastern Alaska. The iron-copper ores on Prince of Wales Island occur as contact deposits, usually associated with diorite, volcanic greenstone, and marble. In the past, considerable examination and exploration have been conducted by the Federal Bureau of Mines on these deposits. In the past they have been mined for their copper only.

The second type of iron ores in Southeastern Alaska, which constitute the major known iron resource of Alaska, is magnetite-enriched pyroxenite or hornblendite. Known magnetite deposits of this type are at Klukwan near Haines, at Snettisham near Juneau, on Duke Island, and near Union Bay on Cleveland Peninsula. Quebec Metallurgical Industries, Ltd., had the Klukwan deposit leased from the Alaska Iron Co. The owners of the Snettisham deposit, W. S. Pekovich and Robert Coughlin, started proceedings to patent 16 claims on the deposit. United States Steel Corp. conducted an examination and exploration project on the Union Bay deposit.

Ore from all of the known large iron deposits in Alaska must be beneficiated before smelting. Tests of the magnetite ore proved that it can readily be concentrated by magnetic separation after the proper grinding to liberate the magnetite from the gangue. Electric-smelting tests conducted on magnetite concentrate from the Southeastern Alaska deposits indicated that this treatment may be economically feasible if low-cost power is developed.

Lead.—Hand-sorted lead ore with a 45-percent lead content, which was shipped to a smelter in the United States in 1953 by Fred Wackwitz from a prospect on Pedro dome near Fairbanks, barely paid shipping charges.

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TABLE 15.—Mine production of gold, silver, and copper in 1954, by regions and districts, in terms of recoverable metals [1]

Region and district [2]	Mines producing [3]		Ore and old tailings (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total		
Cook Inlet—Susitna region: Yentna		11			5,531	5,531		889	889		$194,390
Copper River region: Nelchina		1			80	80		17	17		2,815
Kenai Peninsula region: Hope	1	1	520	209	14	223	62	3	65		7,864
Kuskokwim River region: Aniak		4			19,777	19,777		1,586	1,586		693,630
Seward Peninsula region:											
Council		4			595	595		57	57		20,877
Fairhaven		6			6,489	6,489		769	769		227,811
Kougarok		8			900	900		91	91		31,582
Koyuk		4			245	245		28	28		8,600
Nome		12			21,177	21,177		2,358	2,358		743,329
Southeastern Alaska region:											
Chichagof [4]				76		76	16		16		2,674
Ketchikan [5]			13	4		4	14		14	3,300	1,127
Yukon River region:											
Circle		12			13,650	13,650		1,990	1,990		479,551
Eagle		1			566	566		79	79		19,881
Fairbanks	1	17	194	144	142,225	142,369	26	20,210	20,236		5,001,230
Fortymile		10			2,032	2,032		372	372		71,457
Hot Springs		5			2,576	2,576		701	701		90,794
Iditarod		6			6,798	6,798		1,088	1,088		238,915
Innoko		10			13,538	13,538		1,742	1,742		475,407
Koyukuk		8			423	423		31	31		14,833
Marshall		2			625	625		87	87		21,954
Ruby		5			1,788	1,788		286	286		62,839
Tolovana		3			1,010	1,010		105	105		35,445
Other districts [6]	3	16	19,020	569	7,470	8,039	111	979	1,090	5,100	283,855
Total	5	146	19,747	[7] 1,002	247,509	[7] 248,511	[7] 229	33,468	[7] 33,697	[7] 8,400	8,730,860

[1] No lead or zinc produced in 1954.

[2] Only those districts are shown separately for which Bureau of Mines is at liberty to publish figures; others producing are listed in footnote 6 and their output included with "Other districts."

[3] Excludes itinerant prospectors, "snipers," "high graders," and others who gave no evidence of legal right to property.

[4] No mines producing; gold and silver recovered from mill cleanup at one inactive property in 1954.

[5] No mines producing; gold, silver, and copper recovered from ore shipped from two inactive properties in 1954.

[6] Includes the following districts for which quantities and values cannot be shown separately (number of operations in parentheses): Valdez Creek (1), Willow Creek (1), Cook Inlet-Susitna region; Chistochina (2), Nizina (1), Prince William Sound (none—Property not active; production was not reported until 1954), Yakataga (2), Copper River region; Goodnews Bay (2), Kuskokwim River region; Kiana (none), Shungnak (1), Northwestern Alaska region; Port Clarence (2), Seward Peninsula region; Juneau (1), Southeastern Alaska region; and Chandalar (2), Hughes (1), Melozitna (1), Rampart (2), Yukon River region.

[7] Includes 80 ounces of gold, 30 ounces of silver, and 3,300 pounds of copper recovered from mill cleanup at one inactive property and ore shipped from two inactive properties (indicated in footnotes 4 and 5).

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L. C. Berg continued exploration work on a lead-zinc prospect in Berg Basin near Wrangell in Southeastern Alaska, which he has been developing for a number of years. Harold Herning acquired the Mount Eilson lead-zinc prospect in the Kantishna district near Mount McKinley National Park. The Federal Bureau of Mines conducted a trenching and diamond-drilling program on the Foster lead prospect near the old Omilak silver-lead mine in the Darby Mountains of Seward Peninsula in 1954.

Mercury.—Mercury production in Alaska increased from 40 flasks in 1953 to 1,046 in 1954, largely as a result of a Government-guaranteed price. The DeCoursey Mountain Mining Co., Inc., recovered 1,024 flasks of mercury from ore mined from the Red Devil mine near Sleitmute in the Aniak district. The production would have been greater had not the mine, mill, and some of the camp buildings been destroyed by fire which crippled and closed down the operation on October 22. Twenty-two flasks of mercury were recovered by the Red Top Mining Co. from ore mined before 1954 and retorted in 1954.

The successful operation at the Red Devil mine stimulated prospecting and exploration for mercury in the Aniak district. Russel R. Schaefer conducted exploration on a mercury prospect on Cinnabar Creek and began installing a small retort on the property. George and Oswald Willis and the Western Alaska Mining Co. each conducted exploration work on mercury prospects in the area.

TABLE 16.—Production of mercury, 1945–49 (average), 1950–54, and total 1906–54

Year	Number of mines	Flasks (76 pounds)	Price [1] (per flask)	Value
1945–49 (average)	1	460	$115.99	$53,377
1950–51				
1952	1	28	199.10	5,575
1953	2	40	193.03	7,721
1954	2	1,046	264.39	276,552
1906–54		5,589		898,200

[1] Average yearly price New York from Engineering and Mining Journal.

Nickel.—Exploration work begun in 1952 by the Admiralty-Alaska Gold Mining Co. on the Mertie lode, a nickel-copper-cobalt deposit at Funter Bay on Admiralty Island in Southeastern Alaska, was continued throughout 1954 with DMEA assistance. According to reports, the company staked 38 additional claims in 1954, largely on the basis of information supplied by an airborne magnetometer survey in the vicinity of its operations.

Platinum.—The Goodnews Bay Mining Co. continued to be the only operator in the United States or its Territories that actively mined platinum-group metals as a primary product. Production in 1954 was slightly greater than in 1953. A. L. Howard completed a DMEA contract in 1954 for exploration on a placer-platinum prospect on Red Mountain adjacent to the Goodnews Bay Mining Co. operation.

Silver.—The output of silver in Alaska in 1954 was 33,700 fine ounces—a decrease of 1,690 ounces from 1953. This reduction was

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due to the decrease in gold production as over 99 percent was a recovered byproduct of placer-gold mining. The United States Smelting, Refining & Mining Co. was the principal producer of silver in Alaska in 1954. The company recovered silver as a byproduct of gold from dredging in the Fairbanks district, Yukon River region, and in the Nome district, Seward Peninsula region. The 4 leading producers of gold in 1954 recovered 72 percent of the total silver output in 1954 (compared with 75 percent in 1953); the 15 leading producers of gold recovered 83 percent (compared with 79 percent in 1953).

Tin.—Compared with 1953, tin production in Alaska was quadrupled in 1954, but the companies actively engaged in tin mining or exploration dropped from 4 in 1953 to 1 in 1954. The Northern Tin Co., a steady producer of tin concentrate from its placer-mining operation on Buck Creek on the Seward Peninsula for 1949 through 1953, was idle in 1954. Two companies—Zenda Gold Mining Co. and Alaska Tin Co.—that conducted exploration for tin on Seward Peninsula in 1953 were inactive in 1954.

The United States Tin Corp. mined and milled ore at Lost River on Cassiterite Creek in the Port Clarence district on Seward Peninsula steadily throughout 1954. Tin concentrate, containing 199 long tons of metallic tin valued at $410,000, was produced.

TABLE 17.—Production of tin, 1945–49 (average) and 1950–54

Year	Long tons (Sn content)	Value
1945–49 (average)	11	$25,434
1950	79	170,281
1951	69	197,163
1952	82	220,956
1953	49	105,917
1954	199	409,953

Tungsten.—No tungsten was produced in Alaska in 1954. The DMEA contract for exploration at the Stepovich mine by the Alaska Metals Mining Co., which was begun in 1952, was completed. A discovery was certified. A DMEA contract was authorized to the company in 1954 for exploration at the Yellow Pup mine (adjacent to the Stepovich mine). The work continued throughout the year. The mines are on Gilmore dome in the Fairbanks district.

Before the project recessed for the winter, the Pacific Northern Minerals Co. had conducted preparatory work at the Riverside tungsten-lead-zinc mine near Hyder in Southeastern Alaska. Financial assistance for the work was given under a DMEA contract authorized in 1954. Tungsten was produced from this mine during World War II.

Hugo Lindfors of the Rocky Mountain Mining Co. recovered a small quantity of tungsten concentrate from a sluicing operation on Rocky Mountain Creek in the Nome district, Seward Peninsula region, but the concentrate was not shipped in 1954.

Uranium.—Although no uranium ore was mined in Alaska in 1954 and no commercial deposit discovered, uranium prospecting and exploration of areas with above-normal radioactivity were most

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certainly parts of the mineral industry of Alaska in 1954. The bonus offered by the Atomic Energy Commission and the matching bonus offered by the Territory of Alaska in 1951 for the first 20 tons of 20-percent uranium oxide ore from a single mining location stimulated exploration. Every report of a high radioactive count was headlined in the newspapers, resulting in at least two rushes. The sale of Geiger and scintillation counters skyrocketed, as many hunters and hikers carried radiation-detection equipment. Considerable airborne radiometric reconnaissance was done with scintillation and Geiger counters installed in light planes.

Seven reports of reconnaissance for radioactive deposits in Alaska were published in 1954 by the Federal Geological Survey.[3]

Zinc.—No zinc was produced in Alaska in 1954.

NONMETALS

Clays.—In 1954 Basic Building Products, Inc., of Anchorage, produced clay from two properties near Anchorage where, in 1953, it had built a brick-manufacturing plant. Clay from the Eagle River deposit, 15 miles from Anchorage, was used to manufacture brick and tile. The output from the Sheep Mountain deposit on the Glenn Highway, 113 miles north of Anchorage, was also used at the east Anchorage plant to make firebrick and block.

Gem Stones.—Nephrite jade was recovered as a byproduct of placer-gold mining on Dahl Creek in the Shungnak district, Northwestern Alaska region, by Kobuk Mines (Stout & Thomas, partnership). Ted Tronstad, part owner of the property mined by Kobuk Mines, also recovered some jade from Dahl Creek. The Eskimos living at Kobuk and Shungnak collected jade from this area (Dahl and Cosmos Creeks and vicinity) and sold it in Kotzebue and Fairbanks. The Empire Jade Co. and Shungnak Jade Products Co. recovered and bought jade from this area and cut and polished it in Shungnak and Kotzebue for sale to the tourists and for distribution to jewelry stores in Alaska and the United States. Some of the jade settings in the jewelry sold in Alaska were cut and polished in Germany. A small quantity of Alaska petrified wood and agate was collected; some was cut and polished for jewelry in Alaska in 1954.

Sand and Gravel.—The production of sand and gravel in Alaska in 1954 decreased by more than 1 million tons (7.7 million short tons in 1953 and 6.6 million tons in 1954) below the 1953 output, but the value of the production was increased by more than $1 million ($5.1 million in 1953 and $6.3 million in 1954). The decrease in the production was due mostly to a drop in the requirements for sand and gravel for road paving. The disproportionate value compared with

[3] Wedow, Helmuth, Jr., Reconnaissance for Radioactive Deposits in the Eagle-Nation Area, East-Central Alaska, 1948: Geol. Survey Circ. 316, 1954, 9 pp.
Moxham, R. M., Reconnaissance for Radioactive Deposits in the Manley Hot Springs-Rampart District, East-Central Alaska, 1948: Geol. Survey Circ. 317, 1954, 6 pp.
White, M. G., and West, W. S., Reconnaissance for Uranium in the Lost River Area, Seward Peninsula, Alaska, 1951: Geol. Survey Circ. 319, 1953 (1954), 4 pp.
West, W. S., Reconnaissance for Radioactive Deposits in the Lower Yukon-Kuskokwim region, Alaska, 1952: Geol. Survey Circ. 328, 1954, 10 pp.
Wedow, Helmuth, Jr., Killeen, P. L., and others, Reconnaissance for Radioactive Deposits in Eastern Interior Alaska, 1946: Geol. Survey Circ. 331, 1954, 36 pp.
Wedow, Helmuth, Jr., White, M. G., and others, Reconnaissance for Radioactive Deposits in East-Central Alaska, 1949: Geol. Survey Circ. 335, 1954, 22 pp.
Nelson, A. E., West, W. S., and Matzko, J. J., Reconnaissance for Radioactive Deposits in Eastern Alaska, 1952: Geol. Survey Circ. 348, 1954, 21 pp.

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1953, for the decreased tonnage produced in 1954, was due to a large output in 1953 of lower valued material for paving, the average value of which was 47 cents per short ton. The 1954 tonnage, 25 percent below the 1953 output, had an average value of 97 cents per short ton.

Sand and gravel used for commercial structures in 1954 was about half of the 1953 output. Sand and gravel for construction of United States Government installations in Alaska in 1954 about equaled the 1953 consumption for this use.

Stone.—The output of stone in Alaska in 1954 jumped to 283,700 short tons from 47,100 tons in 1953. The stone was used principally for fill and riprap in constructing causeways and seawalls at United States military installations.

MINERAL FUELS

Coal.—Coal ranked second to gold in terms of value of output by commodities in Alaska in 1954. The value of the coal produced was 26 percent of the total value of all minerals produced. Coal production was 200 thousand tons less in 1954 than in 1953; its value dropped $2 million (24 percent). The reduction was due in part to an overstock of coal built up over several years at some of the United States military installations and to a decision to use this overstock in 1954.

In 1954 coal was produced from three fields in Alaska, as follows: Matanuska, north of Anchorage in the Cook Inlet-Susitna region; Nenana, south of Fairbanks in the Yukon River region; and Point Barrow, on the northernmost tip of Alaska in the Northern Alaska region. Evan Jones Coal Co. in the Matanuska field, and Usibelli Coal Mine, Inc., and Suntrana Mining Co. in the Nenana field were the three largest producers of coal in Alaska in 1954. Mrak Coal Mining Co., Pioneer Coal Co., and Houston Coal Co. in the Matanuska field, Cripple Creek Coal Co. in the Nenana field, and the Alaska Native Service in the Point Barrow field produced smaller quantities of coal.

A few tons of coal was mined from the coal deposits of the Kenai field near Homer in the Kenai Peninsula region by Kibby & Eden to be sold locally or trucked to Anchorage and sold. Coal from this field has been picked from the beach and used by residents of Homer and vicinity for heating and cooking purposes for many years.

TABLE 18.—Production of coal, 1945–49 (average), 1950–54, and total 1880–1954

	Short tons	Value		Short tons	Value
1945–49 (average)	373,422	$2,575,384	1953	861,471	$8,451,542
1950	412,455	3,033,445	1954	666,618	6,442,414
1951	494,333	3,766,987			
1952	686,218	5,779,423	1880–1954 [1]	8,738,296	59,905,374

[1] Production data for 1880–1940 from Federal Geological Survey published records.

Outstanding developments in the coal-mining industry in Alaska in 1954 were: The Federal Bureau of Mines continued its diamond-drilling program on the Wishbone Hill syncline in the Matanuska field to determine the extent, position, and character of coal beds in unprospected parts of the western half of the syncline. It also

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reopened its coal-testing laboratory in Anchorage and ran analyses of samples of coal purchased under United States Government contract. Schools were conducted by the Federal Bureau of Mines at United States military installations where coal was received, to teach personnel proper coal-sampling methods.

Usibelli Coal Mines, Inc., started an undergound coal mine during 1954, in addition to its strip mine, which has been operated for a number of years. The company also installed and operated a coal-washing plant.

The Arctic Coal Co. was the successful bidder in April 1954 on a coal lease of 2,440 acres of land on Lignite Creek in the Nenana field. By the close of the year the company had begun to mine coal and had built a road from the mine to the Nenana River. Until a bridge is built, the company plans to transport coal to the railroad by trucking it across the river on the winter ice. A report [4] on the stripping-coal deposits on Lower Lignite Creek was published in 1954. Reserves in an area of about 24 square miles extending from the Nenana River about 6 miles up the valley of Lignite Creek were estimated at about 95 million tons.

A continuous coal miner, locally called "The Termite" and adaptable to mining coal on a steep dip, was invented by owners of the Suntrana Mining Co. Patents for the machine have been applied for.

Petroleum and Natural Gas.—No production of crude petroleum or natural gas was recorded in Alaska in 1954. However, activity in oil exploration was of boom proportions. Eight major oil companies were engaged in geological-reconnaissance field work in Alaska in 1954. In addition, several Alaskan companies and smaller United States oil companies were active in the Territory. It was reported that these companies expended between 3 and 4 million dollars in exploration activities. Applications for oil leases on almost 4 million acres of land were received by the Federal Bureau of Land Management at Anchorage and Fairbanks, Alaska.

Three companies were engaged in drilling for oil in Alaska in 1954. Phillips Petroleum Co. had drilled to 6,550 feet on December 1, 1954, on its second hole in the Icy Bay area of the Yakataga district, Copper River region. The Alaska Oil & Gas Development Co. had drilled to a depth of 2,700 feet at Eureka in the Nelchina district, Copper River region, when it was forced to close down for the winter. Iniskin Unit Operators, representing the Havenstrite Oil Co., continued a drilling program, begun in 1944 and reactivated in 1953, at Iniskin Bay in the Cook Inlet-Susitna region. A detailed description of activities in the oil industry is found in the Review by Regions section of this chapter.

In addition to the activity in oil in the Alaska Peninsula, Kenai Peninsula, Cook Inlet-Susitna, and Katalla-Yakataga areas, geological reconnaissance work on oil was conducted in the Kateel River area, Hughes district, Yukon River region, by Fairbanks Oil & Gas Co. Oil-land lease applications were filed simultaneously on land

[4] Wahrhaftig, Clyde, and Birman, Joseph H., Stripping-Coal Deposits on Lower Lignite Creek, Nenana Coal Field, Alaska: Geol. Survey Circ. 310, 1954, 11 pp.

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in this area by two parties, a partnership between Texota Oil Co. of Fort Worth, Tex., and Brooks-Scanlon Oil Co. of Minneapolis, Minn., and by the Texas-Yukon Oil Co. of Fairbanks, Alaska.

The United States Navy conducted an exploration program on the Naval Petroleum Reserve No. 4—a 48-million acre withdrawal of land situated between the Arctic Ocean and the Brooks Range in the Northern Alaska region—during the period of 1944 through 1952. Substantial reserves of oil in this field were reported, but no attempt was made to produce oil. Some gas was tapped and was used to heat one of the camps in the Barrow area. An announcement was made of the possibility of releasing the area to the public for private development, but this was not done during 1954. At least two major oil companies—Ohio Oil Co. and Union Oil Co.—publicly announced their interest in the project.

Although the discovery of oil and the development of oil reserves were the primary objectives of the United States Navy exploration program on the Naval Petroleum Reserve No. 4, natural gas was discovered at a number of localities in the reserve. One of these (the Gubic gas field at Umiat, 465 miles north of Fairbanks) was the most promising from the standpoint of commercial development. James W. Dalton, manager of the Railbelt Branch Office of the Alaska Development Board, studied the possibility of commercial development of the Gubic gas field. A report [5] of his findings was published in 1954. His conclusions were that a potential market of sufficient size existed in Fairbanks and vicinity (including the United States military bases) to permit profitable development of the Gubic gas field and transmission of natural gas to the point of use by private industry. He also concluded that it might be possible to expand the natural-gas market to include the Alaska Railroad belt and Anchorage.

REVIEW BY REGIONS

A report [6] that defined the regions and districts in Alaska as they are used by the Federal Bureau of Mines in statistical and economic studies of the mineral industry of the Territory was published in 1954. The following review by regions and districts and the data presented in the tables conform to the pattern established in this publication.

Alaska Peninsula, Aleutian Islands, Bering Sea.—No mineral production was recorded from the Alaska Peninsula, Aleutian Islands, and Bering Sea regions in 1954. The only activities in the mineral industry were investigations of the volcanic sulfur deposits along the Alaska Peninsula and Aleutian Islands and the geologic investigations for oil near Becharof Lake on the Alaska Peninsula.

Bristol Bay.—The only activity in the mineral industry in the Bristol Bay region in 1954, other than sand and gravel produced

[5] Dalton, James W., Possibility of Commercial Development of Gubic Gas Field and Use of Natural Gas as a Source of Heat and Power in the Railbelt Area of Alaska; Alaska Development Board Rept. June 30, 1954, 75 pp.

[6] Ransome, Alfred L., and Kerns, William H., Names and Definitions of Regions, Districts, and Subdistricts in Alaska: Bureau of Mines Inf. Circ. 7679, 1954, 91 pp.

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TABLE 19.—Value of mineral production in Alaska, by regions, 1953–54 [1]

Region	1953	1954	Minerals produced in 1954 in order of value
Aleutian Islands	(2)		
Bering Sea	(2)		
Bristol Bay	$965	$6,717	Mercury, sand and gravel.
Cook Inlet-Susitna	4,415,008	5,623,650	Sand and gravel, coal, gold, stone, clays, copper, silver.
Copper River	336,045	548,182	Sand and gravel, gold, silver.
Kenai Peninsula	(2)	437,062	Sand and gravel, chromite, gold, silver.
Kodiak	(2)	(2)	Stone, sand and gravel.
Kuskokwin River	2,316,047	2,552,029	Platinum-group metals, gold, mercury, silver.
Northern Alaska		(2)	Coal.
Northwestern Alaska	[3] 39,660	67,683	Gold, gem stones, silver.
Seward Peninsula	1,703,526	1,447,480	Gold, tin, sand and gravel, silver.
Southeastern Alaska	578,462	663,317	Sand and gravel, stone, gold, copper, silver.
Yukon River	14,099,608	12,836,204	Gold, coal, sand and gravel, stone, silver.
Undistributed [4]	762,705	229,454	
Total Alaska	24,252,000	24,412,000	

[1] No production reported in Alaska Peninsula.
[2] Included with "Undistributed" to avoid disclosure of individual output.
[3] Value of gem stones included with "Undistributed."
[4] Includes values from regions which must be concealed for particular years (indicated in appropriate column by footnote references 2 and 3).

under Government contract, was reported by the Red Top Mining Co. (formerly Wren, Waskey & Wolfe, partnership). The Red Top Mining Co. recovered 22 flasks of mercury from 20 tons of ore, which had been mined in 1953, at the Red Top Mine 20 miles northwest of Dillingham near Aleknagik.

In 1951 pumice, obtained from the beach at Geographic Bay off Shelikof Strait in the Katmai National Monument was hauled to Anchorage by barge and used as lightweight aggregate in building blocks.

Cook Inlet–Susitna.—The value of sand and gravel produced exceeded that of any other mineral commodity in the Cook Inlet–Susitna region in 1954 because of the large quantity that was used in the continued construction at United States military installations.

Second in value of output was coal, which was produced from four mines in the Matanuska field north of Anchorage in the Willow Creek district. The coal was used in the area by the Government to produce heat and power at military installations, by utility companies to produce power, and by the civilian population for heating and cooking.

The total value of gold output in 1954 from the 11 placer mines in the Yentna district, 1 lode-gold mine in the Willow Creek district, and 1 copper mine in the Valdez Creek district was third in the region in terms of value of output by commodities.

The Iniskin Unit Operators, representing the Havenstrite Oil Co., continued a drilling program for oil at Iniskin Bay, Redoubt district, on the west side of Cook Inlet in 1954. The program had been begun in 1944 and was reactivated in 1953. The company had drilled a hole to the depth of 5,100 feet by October 1954, when an earthquake broke the casing and filled part of the hole. After the earthquake very little progress was made before the operation closed for the winter in November.

Valdez Creek District.—Early in 1954, E. O. Albertson and F. S. Pettyjohn, Jr., sold their copper prospect (Kathleen-Margaret) on

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the MacLaren River, 9 miles north of the proposed route of the Denali Highway between Paxson and Cantwell in the Valdez Creek district, to the Alaska Freight Lines. The Alaska Copper Mines, Inc., was formed, and a DMEA contract was approved for exploration of the prospect. Surface trenching was completed and drifting started before the project was recessed for the winter. A test shipment of 15 tons of ore from the deposit was made to a smelter in the United States; the smelter recovered 5,000 pounds of copper from the ore. A report [7] on an examination of the Kathleen-Margaret copper prospect (made by a geologist of the Federal Geological Survey and an engineer of the Territorial Department of Mines) was published in 1954.

Willow Creek District.—Thirty-four percent of the coal output of Alaska in 1954 came from the Willow Creek district. The Evan Jones Coal Co., one of the three largest coal producers in the Territory in 1954, operated both an underground and a strip mine at Jonesville and washed the coal in a heavy-medium cleaning plant. In addition, this company purchased coal from the Mrak Coal Co., Inc. (strip mine near Eska), and washed it in its plant. The Houston Coal Co. produced and marketed coal from the Houston strip mine during the months of July through October. The Alaska Matanuska Coal Co. mined coal from Pioneer mine, under lease from the Pioneer Coal Co., from May through December.

During 1954 the Federal Bureau of Mines continued its diamond-drilling program in the Matanuska coal field of the district. Four holes, drilled across the synclinal axis to well-defined "marker" beds on the western part of the Wishbone Hill syncline in the vicinity of the old Buffalo and Premier coal mines, indicated continuity of the coal-bearing formations for over 4,000 feet southwestward from the Buffalo-mine workings. Field work was conducted in close cooperation with the Federal Geological Survey.

In the past, Willow Creek district was an important lode-gold-mining district, but in 1954 the Gold Cord mine was the only active mine in the district. During July through September, while doing assessment work, the partnership of Brown & Renshaw mined and milled 240 tons of gold ore. The ore was treated by amalgamation and flotation; a moderate quantity of gold and silver was recovered.

The geology and ore deposits of the Willow Creek mining district were described in a Federal Geological Survey publication.[8]

Yentna District.—The Collinsville mines on Mills Creek was (as in 1952 and 1953) the largest producer of gold in the Yentna district and the fifth largest producer of gold in the Territory in 1954. During the mining season from May 14 to September 20, 1954, the company recovered 4,560 fine ounces of gold and 748 fine ounces of silver (deposited at the United States Mint) and 325 ounces of gold nuggets (sold to individual buyers in the "open market" as "natural gold") from 190,500 cubic yards of gold-bearing gravel (washed in its "dry-land dredge" which was fed by a dragline). Moderate quantities of gold were recovered by placer mining on Cache Creek by James

[7] Chapman, R. M., and Saunders, R. H., The Kathleen-Margaret (K-M) Copper Prospect on the Upper MacLaren River, Alaska: Geol. Survey Circ. 332, 1954, 5 pp.
[8] Ray, R. G., Geology and Ore Deposits of the Willow Creek Mining District, Alaska: Geol. Survey Bull. 1004, 1954, 86 pp.

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Beaver and Forrest L. Englehorn and on Bird Creek by Mike A. Trepte. Other operators that produced smaller quantities of gold from placer mining were Robert Dahl on Nugget Creek bench on Cache Creek, Gagnon Placers on Big Willow Creek, Raymond Gatz on Cache Creek, Gopher Mountain Mining Co. on Little Willow Creek, C. W. Mitchell on Willow Creek, and Harold Stanton on Thunder Creek.

Copper River.—The value of the sand and gravel output in the Copper River region in 1954 represented most of the total value of mineral production from the region. The sand and gravel was used for building and improving roads in the region.

Six placer mines in the Copper River region produced small quantities of gold in 1954—2 each in the Chistochina and Yakataga districts and 1 each in the Nelchina and Nizina districts. The largest producer in the region was the George Belanger & Jack Cameron partnership operation from June 1 to September 14, 1954, on Albert Creek (2,000 cubic yards of gold-bearing gravel was washed to recover 80 fine ounces of gold and 17 fine ounces of silver).

The Bear Creek Mining Co., exploration subsidiary of the Kennecott Copper Corp., conducted an exploration project on the copper prospect owned by Martin Radovan in the Nizina district. The Northern Pyrites Co. took options on two sulfide deposits on Latouche Island in the Prince William Sound district and conducted geophysical prospecting on them in 1954.

Phillips Petroleum Co. continued an exploration program for oil begun in 1953 in the Icy Bay area of the Yakataga district. Kerr-McGee Oil Industries conducted the program for Phillips in 1953 and in early 1954. The first hole was abandoned at a depth of 4,800 feet. It was reported that the second hole was down to 6,550 feet on December 1, 1954. The company holds nearly 1 million acres for exploration under a special agreement with the United States Department of the Interior which calls for 12 holes to be drilled in a 10-year period.

The Alaska Oil & Gas Development Co. of Anchorage continued its exploration program for oil begun in 1953 at Eureka in the Nelchina district. The company had drilled to a depth of 2,700 feet before it was forced to close for the winter.

Kenai Peninsula.—The continued and expanded exploration program for oil on the Kenai Peninsula by 3 major oil companies, the production of chromite (first since 1944) from Red Mountain near Seldovia in the Homer district and gold and silver production from 1 placer mine and 1 lode mine in the Hope district were the 3 outstanding events in the mineral industry of the Kenai Peninsula region in 1954.

At least three of the major oil companies—Shell Oil Co., Standard Oil Co. of California, and Richfield Oil Co.—had acquired oil-land leases and had conducted exploration (geological and geophysical) in the Kenai Peninsula region by the close of 1954. The Shell Oil Co. had a party conducting geological reconnaissance work in the field on Kenai Peninsula throughout the summer. Robert H. Ray Co. conducted seismic exploration under contract for the Standard Oil Co. of California on its 750,000 acres of ground held under an oil-land lease. Late in 1954, the Richfield Oil Co. began work on the 90,000 acres of land it had leased.

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Homer District.—The Kenai Chrome Co. made its first shipment of almost 3,000 long tons (gross weight) of chromite from the Star Four mine on Red Mountain near Seldovia in October, 1954. Freighter shipments were interrupted when a storm forced the freight boat to leave before it could be loaded. GSA contracted to buy 13,000 tons of chromite from the company.

In the same area in 1954 the Seldovia Chrome Co., Inc., made a small test shipment of chromite, which was collected from four claims of the Chrome Maverick group in the Fish Creek area.

Hope District.—The Surprise Creek Mining Co. (James O'Brien and James Dunsmire) recovered 14 fine ounces of gold and 3 fine ounces of silver from 160 cubic yards of gold-bearing gravel that was mined from a drift placer mine on Surprise Creek between July 1 and October 15, 1954. Rather than sink a vertical shaft to bedrock and drift on bedrock to mine the gravel, as is the usual practice, a drift was driven from the surface headed upstream on the horizontal until the sloping bedrock and gold-bearing gravel on bedrock were intersected.

The Patrick W. Bogan & George Massoz partnership operated the East Point mine on Falls Creek at mile 26 on the Seward-Anchorage highway during 1954. From 520 tons of gold ore mined and amalgamated in the mill, 209 fine ounces of gold and 62 fine ounces of silver were recovered. The East Point mine was last operated in 1945 by Roy E. Luckie & Co.

Kodiak.—Exploration conducted on a tungsten prospect by the Kodiak Exploration Co. was the only activity in the mineral industry on Kodiak Island in 1954.

Kuskokwim River.—Minerals produced in the Kuskokwim River region in 1954, in order of value of output, were platinum-group metals, gold, mercury, and silver. The Goodnews Bay Mining Co. was the only operator in the United States or its Territories that produced platinum-group metals as a primary product. The second largest producer of gold in Alaska in 1954, New York-Alaska Gold Dredging Corp., operated 3 dredges at Nyac in the Aniak district of Kuskokwim River region. Most of the mercury output of Alaska came from the DeCoursey Mountain Mining Co. operated at the Red Devil mine near Sleitmute on the Kuskokwim River. Silver was produced as a byproduct of gold from placer mining.

Aniak District.—In 1954 the new York-Alaska Gold Dredging Corp., the largest producer of gold in the Aniak District and Kuskokwim River region and the second largest in the Territory, operated 3 electrically powered bucketline dredges (1 more than in 1953) on the Niukluk River and California Creek near Nyac. A placer operation (employing a nonfloating washing plant, elevated sluice box, fed by a dragline with a 1½-cubic-yard bucket) on Rock Creek, a tributary of California Creek, was not operated by the company in 1953 or 1954.

Donlin Placers (Robert F. Lyman) was the second largest producer of gold in the Aniak district in 1954. A bulldozer was used for digging and delivering the gold-bearing gravel of Snow Gulch, a tributary of Donlin Creek, to a string of sluice boxes for washing to recover the gold. Water was supplied to the sluice boxes from the creek in Snow Gulch and recirculated with a pump. Two other placer operations

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in the district, Canyon Creek Mining Co. (Jens Kvamme & Son) on Canyon Creek and Russel R. Schaefer on Forty-seven Creek (a tributary of the Holitna River) produced small quantities of gold. In the years before 1954 (1951–53), Russel R. Schaefer marketed scheelite concentrate as a byproduct of the gold-placer operation.

The DMEA contract for exploration work at the Red Devil mine near Sleitmute on the Kuskokwim River by the DeCoursey Mountain Mining Co. was completed during 1954. Important discoveries of ore were made which resulted in the production of 1,024 flasks of mercury from Red Devil mine during 1954. A disastrous fire on October 22 destroyed the hoist house, power house, mine buildings, and reduction plant. At the close of the year, no plans had been announced by the company.

Goodnews Bay District.—The Goodnews Bay Mining Co. operated its electrically powered bucketline dredge (with ninety-three 8-cubic-foot buckets) on a bench on the Salmon River near Platinum during the 1954 mining season from April 24 to November 4. Platinum-group metals were the primary products, but a moderate quantity of gold was produced as a byproduct. A. L. Howard continued an exploration program (begun in 1953 under a DMEA contract) on a placer-platinum prospect on McCann Creek (adjacent to the Goodnews Bay Mining Co. operation).

Mumtrak Miners, a new operation in 1953, recovered a substantial quantity of gold from a placer mine on Watamuse Creek in 1954. A dragline was used to dig and deliver the gold-bearing gravel to a set of elevated sluice boxes where the gravel was washed to recover the gold. Two bulldozers were used for moving tailing and overburden.

McGrath District.—Strandberg & Sons continued an exploration and development program (begun in 1952) on the Nixon Fork mine, 10 miles north of Medfra on the Kuskokwim River, upriver from McGrath. The mine was a steady gold producer for 20 years before 1948. A project was conducted to work out a process to recover gold and copper in the tailing from prior operations and to develop a method for recovering the copper (silicate) from the ore.

Northern Alaska.—About 1,000 short tons of coal was mined from the Meade River mine in the Point Barrow field by the Alaska Native Service and used by the residents of Barrow for heating and cooking. A small quantity of natural gas from one of the holes, which was drilled during a United States Navy exploration program for oil near Barrow, may also have been used by inhabitants of Barrow.

Northwestern Alaska.—Kobuk Mines (Charles E. Stout and William P. Thomas) operated its placer mine on Dahl Creek in the Shungnak district in 1954 and recovered a substantial quantity of gold. Nephrite jade was recovered as a byproduct and sold to buyers for making jewelry. Ted Tronstad, part owner of the property (leased to Kobuk Mines) recovered some jade from Dahl Creek and marketed it during 1954. The Eskimos that lived in the villages of Kobuk and Shungnak collected jade from the same area (Dahl and Cosmos Creeks and vicinity) and sold it in Kotzebue and Fairbanks.

Two companies, the Empire Jade Co. and Shungnak Jade Products Co., were actively engaged in cutting and polishing jade from the Shungnak district in 1954.

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Rhinehart Berg and his partners conducted exploration work on their copper prospect on Ruby Creek in 1954. The work consisted of trenching with a bulldozer.

Seward Peninsula.—In 1954 the value of the minerals produced in the Seward Peninsula region comprised 6 percent of the total value of the minerals produced in the Territory. The value of the gold output was 71 percent (93 percent in 1953) of the total value of the minerals produced in the region in 1954; the value of tin output was 28 percent, which was significant. Tin output quadrupled compared with 1953. Other products were sand and gravel, for construction, and silver as a byproduct of gold from placer mines.

Eighty-seven percent (78 percent in 1953) of the gold was produced by 8 bucketline dredges operated by 5 companies. Thirty-one other placers produced gold by using hydraulic giants, bulldozers, draglines, and handtools, either separately or in combination with sluice boxes.

Council District.—Coplin Consolidated Enterprises, a new company in 1954, operated a dredge on the Niukluk River near Council. The property and the dredge were leased from the Council Dredging Co.; they had not been operated since 1949. The Alaska Placers Co., a steady producer of gold since 1939, did not operate its dredge on benches of the Niukluk River in 1954.

The Last Chance Mining Co. (William Munz, owner) operated the Last Chance placer mine on Rock Creek. A bulldozer was used to dig and deliver gold-bearing gravel to sluice boxes. The Pancake Mining Co., a family partnership of 4 persons and a new operation in 1954, recovered a small quantity of gold from its placer mine on Pancake Creek during 14 days of actual mining; in addition, a development and exploration program was conducted for 2 months during the year.

The Federal Bureau of Mines conducted an exploration project at the Foster Lead prospect near the old Omilak silver-lead mine in the Darby Mountains to determine the source of high-grade silver-lead float that was found at the prospect. The work on the project consisted of trenching and diamond drilling.

Fairhaven District.—The Casa De Paga Gold Co. operated two 3-cubic-foot flume-type dredges on the Inmachuk River, 20 miles south of Deering, during the 1954 mining season. The company was the largest producer of gold in the Fairhaven district, second largest in the Seward Peninsula region, and sixth largest in the Territory. The company removed over 200,000 cubic yards of overburden with 3 bulldozers and dug and washed 302,040 cubic yards of gold-bearing gravel to recover 4,289 fine ounces of gold and 446 fine ounces of silver. In addition, the company thawed over 100,000 cubic yards of the gold-bearing gravel handled by the dredges.

Havenstrite Oil Co., Mining Division, recovered a substantial quantity of gold from its placer mine on Candle Creek from July 1 to October 1, 1954. Hydraulic giants were used for removing the overburden, bulldozers were used for digging and delivering the gold-bearing gravel to the sluice boxes, and draglines were used for moving and stacking tailing. Otto F. and Fred A. Weinard recovered a moderate quantity of gold from their placer mine on Mud Creek in 1954. Hydraulic giants were used for removing overburden; one

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bulldozer was used for digging and delivering the gold-bearing gravel to sluice boxes and another for moving tailing.

Other placer operators who produced smaller quantities of gold in the district were Jack Hoogendorn on the Immachuk River, Mike Sankovich on Glacier Creek, and Henry Xavier on Gold Run Creek.

Kougarok District.—N. B. Tweet & Sons recovered 471 fine ounces of gold and 47 fine ounces of silver from its placer operations on Kougarok River near Taylor in 1954. Hydraulic giants were used to remove an average of 20 feet of ice and frozen soil ("muck") from the gold-bearing gravel on a bench of the river. The gravel was mined and delivered to sluice boxes with bulldozers. In addition, the company operated a dredge on the Kougarok River for 3 weeks just before the freezeup. The Rainbow Mining Co. (S. A. Montague and F. H. Whaley) recovered a moderate quantity of gold from the Rainbow placer mine on the Noxapaga River. Whaley became sole owner of the company on August 15, when he bought the one-half interest held by Montague. Atlas Mines (George J. Waldhelm) operated a placer mine on Dahl Creek. Two hydraulic giants were used to strip the overburden from the gold-bearing gravel. A bulldozer dug and delivered the gravel to sluice boxes for removal of the gold. A slackline drag scraper removed and stacked the tailing from the sluice boxes.

Other placer mines in the district were those of George Bodis on Dick Creek, Midnite Sun Mines (Erick Kveven and Kay Handleman, partnership) on Miller Creek (tributary to Skookum Creek), Tiger Talisman Placers (J. Houston Alexander) on Dahl Creek, and Andrew Wirum on Dome Creek.

Koyuk District.—A moderate quantity of gold was recovered from a placer mine on Sweepstake Creek by Patrick J. Bliss. Through a lease from S. A. Tucker, Bliss controlled the entire creek. Sweepstake Mines (Charley Moon), which had been a steady small placer-gold producer in years before 1954, did not operate on Sweepstake Creek. Carl Swanson recovered a small quantity of gold from his placer mine on Dime Creek by using a hydraulic mining method; he also conducted maintenance and development work at his drift mine on Dime Creek. Carl Swanson's brother Oscar mined placer gravels on Dime Creek with a bulldozer.

Nome District.—In 1954, 72 percent of the gold output of the Seward Peninsula region came from the Nome district. Three companies in the district operated 5 bucketline dredges, 2 companies or individuals operated placer mines where bulldozers and draglines were used, and 6 individuals mined small quantities of gold by using small-scale handtools.

The United States Smelting, Refining & Mining Co. (Nome unit) was the largest producer of gold in the Seward Peninsula and the third largest in the Territory in 1954. The company operated 2 of its fleet of 4 electrically powered bucketline dredges at Nome throughout the mining season. The largest dredge of the fleet (equipped with 134 9-cubic-foot buckets) was out of commission for the remainder of the year after 5 days of operation when its digging ladder was broken as a result of a cave-in of the bank. This mishap was a serious loss to the company operation at Nome, especially after loss of another dredge in the spring of 1953, when it turned over in the dredge pond.

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During 1954 the machinery was salvaged from the overturned dredge, and it will be installed in a new hull on the "Submarine Beach." The Submarine Beach is a quarter mile inland from the present ocean beachline at Nome; its name was derived from the fact that it is below sea level. Thawing of the gravels of the Submarine Beach deposit in preparation for the dredging operations was in progress in 1954.

Lee Bros. Dredging Co., the second largest gold producer in the district in 1954 and ninth largest in the Territory, operated 2 diesel-powered flume-type dredges on the benches of the Solomon River; 1 dredge was equipped with sixty-six 3½-cubic-foot buckets, and 1 had seventy-five 5-cubic-foot buckets.

The Kougarok Freight & Mining Co. (Earl Towner and Elmer Straub, partnership) operated its flume-type diesel-powered dredge (open-link bucketline with thirty-two 1-cubic-foot buckets) on Buster Creek from June 1 to October 1, 1954. The dredge, built in 1950 by the owners from various parts of abandoned mechanical equipment, has been operated each year during the mining season without outside help. The original buckets were from a ditch digger, the bucket chain was fabricated from old bulldozer tracks (rails), and the pontoons were oil drums, fastened together with cable. The ingenuity of an Alaska placer miner in adapting and making use of materials at hand would be hard to match.

A partnership of Herbert Engstrom and Samuel Parkinson, which operated as the Basin Creek Mining Co. at its placer mine on Basin Creek from September 5 to October 24, 1954, produced a moderate quantity of gold. The partners reported that they sold some of the nugget gold produced in 1954 to jewelers in Nome. The mining method used at Basin Creek was unique in Alaska. Over 30 feet of barren slide rock overlaying the gold-bearing gravel was removed with a dragline. The gold-bearing gravel was dug and loaded into trucks with a power shovel and hauled to the washing plant. This method was adopted to keep the washing plant out of the cut where it had been buried several times as a result of flash floods.

Moderate quantities of gold were recovered from placer operations by Ace Mining Co. on Darling Creek and by H. W. Edwards at the Quigley mine on Solomon River. Both operations used bulldozers to dig and deliver the gold-bearing gravel to sluice boxes.

Six small-scale hand placer operations in the Nome district marketed a total of 38 ounces of gold in 1954; 2 of these operations worked on the Nome beach sands.

Port Clarence District.—The United States Tin Corp. operated the only active tin mine in Alaska in 1954. The company mined and milled 30,030 short tons of tin ore from the Lost River mine on Cassiterite Creek and up graded 77 short tons of tin concentrate that, produced in 1953, had been too low in tin content and too high in impurities to ship. From the ore and concentrate milled in 1954, 372 short tons of concentrate containing 199 long tons of tin was produced.

One company (Northern Tin Co.) that produced tin from its placer mine in 1953 and two companies (Zenda Gold Mining Co. and Alaska Tin Co.) that conducted exploration projects for tin in 1953 were inactive in 1954.

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A small placer hydraulic mine was operated on Gold Run Creek in 1954 by Henning Johnson. Olaf Martinson operated a small-scale hand placer on Gold Run Creek.

Southeastern Alaska.—Mineral production in the Southeastern Alaska region in 1954 was reported from 1 active lode mine in the Juneau district where tailing was re-treated, from shipment of copper and gold ore that had been mined in years before 1954 from 2 mines in the Ketchikan district, and from a cleanup at a mine in the Chichagof district. Activities of companies that were engaged in exploration and development work only are described in the Review by Commodities section of this publication.

Chichagof District.—The Island Cove Mining Co. recovered 76 fine ounces of gold and 16 fine ounces of silver from a cleanup of the old Chichagof mill in 1954.

Juneau District.—The one mine reported active in the Southeastern Alaska region in 1954 was in the Juneau district. Howard Hayes re-treated 18,765 short tons of tailing from the Alaska Juneau mill by placer-mining methods to recover 412 fine ounces of gold and 82 fine ounces of silver. The tailing was delivered to a string of sluice boxes with power-excavating equipment where the material was washed to recover the gold by gravity separation.

The Alaska Juneau Mining Co. continued to keep maintenance crews at its mine, mill, shops, and powerplants in 1954.

Ketchikan District.—Eleven tons of copper ore, which had been stockpiled at the Rich Hill mine in years before 1954, were loaded aboard the boat *Eureka* as ballast and hauled by the owner of the mine and boat to the United States, where the ore was smelted. Two tons of gold ore was shipped to a smelter in the United States in 1954 by Robert A. Novatney, who had mined the ore in prior years from the Miller Ledge & Lode at Helm Bay.

Yukon River.—The value of the output of gold, coal, sand and gravel, stone, and silver (in order of value of output) in the Yukon River region in 1954 was 52 percent of the value of the output of all minerals in Alaska. The gold output of the region was 77 percent of the Alaskan total gold output. Seventy-nine percent of the gold came from 12 dredges operated by 7 individuals and companies in the region in 1954. In addition to the dredges, 78 placer mines were active. These used nonfloating washing plant, hydraulic, or small-scale hand-mining methods.

Gold was produced at one lode-gold mine in the region by Jokela and Lazeration from the Greenback claims in the Fairbanks district. One company, Alaska Metals Mining Co., continued an exploration program on a lode-tungsten deposit on Gilmore Dome in the Fairbanks district.

Nearly two-thirds of the coal output for Alaska in 1954 came from the three producing coal mines in the Nenana field, Bonnifield district, of the Yukon River region.

Bonnifield District.—Three companies produced coal from the Nenana field in the Bonnifield district in 1954. Usibelli Coal Mine, Inc., the largest producer of the three, mined coal from its strip-coal mine on the Healy River. The coal was hauled by truck from the mine to the railroad at Suntrana. Hydraulic giants, assisted by bulldozers, were used to thaw and strip the overburden from the coal

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beds. Late in the year the company began an underground coal-mining operation and built a heavy-media coal washing plant.

Suntrana Mining Co. Inc., mined coal steadily throughout the year from its underground coal mine at Suntrana. The Cripple Creek Coal Co. mined coal from its strip-coal mine on Cripple Creek (a tributary of the Healy River) from January through April and during November and December 1954. The overburden was thawed and stripped from the coal with hydraulic giants and bulldozers. The coal was hauled to the railroad at Suntrana in trucks.

Chandalar District.—After lying idle since the close of the 1950 mining season the placer-mining supplies and equipment formerly owned and operated by R. W. Sellers on Big Creek were bought at a marshal's sale by the Chandalar Mining Co. (Hugh J. Matheson, Jr., owner) on April 23, 1954. During the mining season the company recovered a substantial quantity of gold by using bulldozers to supply gold-bearing gravel to sluice boxes where the gold was removed. Two of the few remaining Alaska veteran prospectors, A. W. Amero and Ellis Anderson, were active again in 1954 on Big Creek and Tobin Creek, respectively.

Circle District.—The Alluvial Golds, Inc., the largest producer of gold in the Circle district in 1953, did not operate its dredge on Woodchopper Creek in 1954. The entire season was spent on a stripping operation to remove the overburden from the gold-bearing gravel in preparation for future dredging. The dredge crew was used by a sister company, Gold Placers, Inc., on its dredge on Coal Creek, which had not operated in 1953. Gold Placers, Inc., was the largest producer of gold in the district and the fourth largest in the Territory in 1954. The practice of dredging at one property while stripping at the other, and alternating the process the next year, was adopted to take advantage of "solar thawing."

The second largest producer of gold in the district was P. R. & H. Mining Co. (Parker, Raymond & Hopkins, partnership), which operated a placer on Mastodon Creek for the second year in 1954. Bulldozers were used to remove the overburden, to dig and deliver the gold-bearing gravel to sluice boxes, and to stack the tailing.

Timberline Placers (K. C. Spaid and H. L. Stout, partners) recovered a substantial quantity of gold from its placer mine on Porcupine Creek; it used a method of mining similar to the method used by P. R. & H. Mining Co., except that a dragline was used to stack the tailing.

A dredge (equipped with fifty-eight 3½-cubic-foot buckets) was operated on Crooked Creek from June 5 to October 9, 1954, by the Circle Dredging Co., Inc., Tury F. Anderson, president. Over 2 weeks of the best part of the mining season was lost in raising and repairing the dredge after it hit a reef of frozen ground and sank on July 21.

Deadwood Mining Co. (E. H. and W. F. Wrede, partners) recovered a substantial quantity of gold from Independence Creek. The property was under lease from Ester Zimmerman of Fairbanks. The gold-bearing gravel was mined and delivered to sluice boxes with a combination of bulldozer and hydraulic giant equipment. The gravel contained clayey material which interfered with the recovery of gold in the sluice boxes; therefore, hydraulic giants were used to

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prewash the gravel before the bulldozers delivered it to the sluice boxes.

Lucky Seven Mining Co., Walter E. Roman, owner, recovered 870 fine ounces of gold and 195 fine ounces of silver during the period June 10 to September 17, 1954, from gravel mined with bulldozers and washed in sluice boxes. Bulldozers were used also to remove and stack the tailing from the washing operation.

Other producers of substantial quantities of gold from placer mines in the district were Delta Alaska & H. C. Carstens (partnership) on Portage Creek, Frasca & Hering (partnership) on the McGowen Bench on Eagle Creek, and Robert R. Wilkinson (family operation) on Miller Creek. No men were hired by any of the three companies; all work was done by the partners or immediate family.

Small quantities of gold were recovered by Paul Bittner on Deadwood Creek, by Ketchum Creek Mining Co. on Ketchum Creek, and by Squaw Creek Mining Co. on Squaw Creek. The latter two placer operations were new in 1954.

Eagle District.—As in 1953, Burnett F. Hansen was the only active mining operator in the Eagle district in 1954. With the help of his half brother, George E. Frey, Barney Hansen recovered 337 fine ounces of gold and 36 fine ounces of silver from 10,700 cubic yards of gold-bearing gravel mined with bulldozers from Crooked Creek and washed in a "string" (several sluice boxes, 10 to 12 feet long, joined together) of sluice boxes, which was equipped with a sluice plate.

Fairbanks District.—Fifty-seven percent of the gold produced from Alaska placer mines in 1954 came from the Fairbanks district (54 percent in 1953). Seventeen placer-gold mines (the United States Smelting, Refining & Mining Co. with 6 operating dredges in the Fairbanks area, was considered as 1 operation) and 1 lode-gold mine produced gold in the district in 1954.

Again in 1954, as for many years past, the Fairbanks unit of the United States Smelting, Refining & Mining Co. was by far the largest producer of gold in the Fairbanks district and in the Territory. The company pumps for supplying water to the stripping, thawing, and dredging operations, as well as its dredges, were powered by electricity generated at a central coal-burning plant in Fairbanks. Water for the company operations north of Fairbanks was supplied by the 90-mile-long Davidson Ditch from the head of the Chatanika River to Fairbanks; water for the operations in the Ester area was pumped from the Chena River. The six dredges operated in 1953 continued to operate at the same locations in 1954. In addition to the gravel handled by the dredges, over 6 million cubic yards of overburden was removed with 225 hydraulic giants and 3 draglines in preparation for future dredging. After the close of the mining season in 1954, dredge 5 was moved from Little Eldorado Creek to Dome Creek. The 10-mile overland move was accomplished by cutting the dredge into 150-ton sections, which then were loaded on sleds and hauled by bulldozers to the new site, where they were reassembled.

The Alder Creek Mining Co. was the second largest producer of gold in the district in 1954. The placer-mining method was unique to Alaska in that a dragline rather than a bulldozer was used to dig and deliver the gold-bearing gravel to a sluice plate at the head of the sluice boxes which were placed on or near bedrock. A second

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dragline was used to remove and stack tailing from the washing operation. Between May 15 and September 10, 2,296 fine ounces of gold and 372 fine ounces of silver were recovered, despite the fact that the company was the victim of a crime such as has not occurred in the Fairbanks area since the boom days shortly after the gold rush to Fairbanks. The owners found several sluice boxes empty when they started to clean up one morning. It appeared that the gold had been robbed from the sluice boxes during the night. The owners estimated the loss at $10,000.

The Gold Stream Mining Co., Inc., Denny G. Breaid, president, a new producer of gold in the District in 1954, recovered 785 fine ounces of gold and 70 fine ounces of silver by washing in sluice boxes 17,360 cubic yards of gravel from Goldstream Creek. In addition, 7,400 cubic yards of overburden was removed during the year. The company had spent the entire 1953 mining season stripping the overburden from the ground worked in 1954.

Ernest L. Maurer recovered 234 fine ounces of gold and 20 fine ounces of silver from 5,000 cubic yards of gold-bearing gravel washed at his placer bulldozer-hydraulic mine on First Chance Creek from May 1 to August 5, 1954. In addition, 10,000 cubic yards of overburden was thawed and removed with hydraulic giants.

Other operators that produced moderate to substantial quantities of gold from placer mines by using combinations of dragline, bulldozer, and hydraulic equipment with sluice boxes were Chatham Creek Mining Co. on Chatham Creek, Hassel Mining Co. on Ready Bullion Creek, and Helmer Johnson on Cleary Creek.

The one active lode mine in the Yukon River region in 1954 was in the Fairbanks district. Vern Jokela and Charles Lazeration, a partnership with no outside employees, mined 194 tons of gold ore from the Creighton mine on the Greenback claims at the head of Little Eldorado Creek. The ore was milled at the Cleary Hill Mines Co. mill by the partners to recover 144 fine ounces of gold and 26 fine ounces of silver.

In 1954 the Alaska Metals Mining Co. continued its exploration program (started in 1951) on the lode-tungsten deposits on Gilmore Dome; the program received government aid through a DMEA contract.

Fortymile District.—In 1954 the United States Smelting, Refining & Mining Co. continued a stripping program begun in 1953 on its placer ground at Chicken on Chicken Creek, a tributary of Mosquito Fork and a famous old mining camp. The ground was being prepared for a possible future dredging operation. Hydraulic giants were used for thawing and stripping the overburden from the gold-bearing gravel.

LaCross Mining Co. (Jack LaCross and Fred Whitehead, partners) conducted work, chiefly prospecting, on various creeks near Boundary in 1954. From 45,000 cubic yards of gold-bearing gravel washed from Turk, Davis, and Poker Creeks and from Walkers Ford between June 16 and September 20, 622 fine ounces of gold and 88 fine ounces of silver were recovered. Bulldozers were used for delivering the gravel to the sluice boxes and for removing tailing and overburden.

Purdy Bros. (Arthur H. and Fred W.) recovered 87 fine ounces of gold and 17 fine ounces of silver from 2,000 cubic yards of gravel

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washed from May 15 to September 20 at their placer operation on Myers Fork (tributary of Chicken Creek). In addition, 6,000 cubic yards of overburden was thawed and stripped with hydraulic giants and a bulldozer.

Two placer mines new in 1953—Dan Manske on Ingle Creek and George F. Robinson on Jack Wade Creek—continued operations in 1954. Others recovered moderate quantities of gold from placer mines by using combinations of dragline, bulldozer, and hydraulic equipment for removing the overburden and for mining and delivering the gold-bearing gravel to sluice boxes. They were Chicken Hill Mines, Inc. (George Turner), on Lost Chicken Hill, Franklin Mining Co. on Chicken Creek, William Meldrum on Stonehouse Creek (tributary of Chicken Creek), and Squaw Creek Mining Co. (Jack Wilkey) on Canyon Creek.

Hot Springs District.—Five placer operations produced small to moderate quantities of gold in the district in 1954. All operations used various combinations of bulldozer, dragline, and hydraulic equipment to strip the overburden, mine the gravel, and remove the tailing, and nonfloating washing plants (sluice boxes on or near bedrock) to wash the gravel to recover the gold. These operations were Enstrom & McDougall on New York Creek, Johnson & Isaacson on Eureka Creek, Tony Lanning on Thanksgiving Creek, Rhode Island Creek Mines (A. W. Pringle) on Rhode Island Creek, and Stranberg & Sons on Eureka Creek.

Hughes District.—Strandberg & Sons, the only producer of gold in the Hughes district in 1954, recovered a substantial quantity of gold from its placer on Indian River. One dragline was used to strip overburden. A second dragline was used to dig and deliver the gold-bearing gravel to a portable self-contained nonfloating washing plant, commonly called a dryland dredge.

Iditarod District.—Of the 6 active placer operations in the district in 1954, 2 used dredges, 2 used mechanical excavating equipment and sluice boxes, and 2 used hydraulic giants and sluice boxes. North American Dredging Co. (Alex Mathieson, owner) operated a dredge with seventy 3½-cubic-foot buckets on the Mohawk Association of claims near the mouth of Flat Creek where it enters Otter Creek and on Otter Creek, from June 1 to November 29, 1954. In addition to working on virgin placer ground, the company reworked ground and tailing from the Yukon Placer Co. dredging operation that discontinued operations in this area in 1919. Steen & Ogriz, a new dredging operation in 1953, continued to operate the J. E. Riley Investment Co. bucketline dredge on Otter Creek in 1954. The flume-type dredge with a trommel screen (relatively few flume-type dredges in operation in Alaska are equipped with a trommel screen) had fifty-eight 3½-cubic-foot buckets.

Miscovich Bros. reworked tailing from previous operations and redug the bedrock on Discovery Claim on Otter Creek with bulldozers and a hoe shovel. The gravel was washed in sluice boxes to recover the gold. Tailing from the washing operation was removed and stacked with a dragline. Prince Creek Mining Co. (Harry Agoff) recovered a substantial quantity of gold from placer mining on Prince Creek with a combination of bulldozer and hydraulic equipment.

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Gust Backstrom worked the Idaho placer mine at the head of Flat Creek by hydraulic methods. Julian Stuver reworked tailing from previous operations on Happy Creek; a hydraulic giant was used to deliver the gravel to sluice boxes.

Innoko District.—The Ophir Mining Co. recovered a substantial quantity of gold from dredging on Ganes Creek in 1954. In 1953 the company had rehabilitated the dredge, which was last operated by the Innoko Dredging Co. in 1951, and operated it throughout the 1953 mining season. A small, flume-type, bucket line dredge was operated on Lower Ganes Creek during June by Tom Woolard of the Bedrock Mining Co.

The two placers on Colorado Creek (Strandberg & Sons and Colorado Creek Mining Co.) recovered substantial quantities of gold during 1954. Strandberg & Sons used a dryland dredge (portable, nonfloating, track-mounted, washing plant with a hopper, trommel screen, tables, and stacker), which was fed by a dragline, to recover the gold from the gravel. Colorado Creek Mining Co. used bulldozers to dig and deliver the gold-bearing gravel to sluice boxes and a dragline to remove and stack the tailing and strip the overburden. Over 120,000 cubic yards of overburden was stripped, and 80,000 cubic yards of gravel was washed.

Other placers that produced moderate to substantial quantities of gold in the district in 1954 were Bedrock Mining Co. on Bedrock Creek, Ivor Carlson on Little Creek, Degnan Mining Co. on Esperanto Creek, Eric Hard on Newsboy claim on Cripple Creek, Rosander & Reed on Yankee Creek, and Uotila & Hard on Ophir Creek; each used a combination of dragline, bulldozer, and hydraulic equipment with nonfloating washing plants (sluice boxes) to handle and wash the gravel to recover the gold. Each of these operators had been a steady producer in preceding years.

Kantishna District.—Earl R. Pilgrim & Co. conducted exploration work throughout 1954 at the Stampede antimony mine. The work continued the project begun in 1952 under a DMEA contract.

Koyukuk District.—Eight small placer-gold mines were active in the district in 1954; 423 fine ounces of gold and 31 fine ounces of silver were produced. The largest producer of gold was the A. S. Mining Co. on Mascott Creek. The second largest was the Slate Creek Mining Co. on Slate Creek. Prospectors, Inc., recovered a small amount of gold from prospecting on Myrtle Creek. The above 3 operators used bulldozers to dig and deliver the gold-bearing gravel to sluice boxes; the 5 remaining operators used hydraulic giants or handtools to mine the gravel that was washed in sluice boxes to recover the gold.

Marshall District.—Lars Ostnes & Co. recovered 511 fine ounces of gold and 65 fine ounces of silver from 50,000 cubic yards of gold-bearing gravel mined from Willow Creek between June 1 and October 2, 1954. A dragline was used to dig and deliver the gravel to a dryland dredge (similar to the one described above) where it was washed. The dragline was used also for stripping 30,000 cubic yards of overburden.

Melozitna District.—The Iditarod Operating Co. placer mine on Golden Creek was the only active mine in the district in 1954.

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Rampart District.—The Little Minook Mining Co., which has been a steady producer of gold from its placer mine on Little Minook Creek for the past 10 years or more, was idle in 1954. Albin and Alice Martin and Albert Bernard worked the property as a three-way partnership during 1954. From 2,500 cubic yards of gravel mined by hand methods and washed in sluice boxes, the partnership recovered 267 fine ounces of gold and 23 fine ounces of silver. Swanson Bros. recovered a small quantity of gold from their placer mine on Hunter Creek.

Ruby District.—This district gained a new placer operation but lost an old one in 1954. Patrick Savage moved in from the Iditarod district to mine on Long Creek as the Northern Lights Mining Co. Granite Creek Mining Co. (William Carlo) was inactive.

Three other placer mines that used combinations of dragline-bulldozer-hydraulic equipment to mine and wash the gold-bearing gravel to recover moderate to substantial quantities of gold were Long Creek Mining Co. (Long Creek), Miscovich Bros. (Poorman Creek), and Clarence Zaiser (Greenstone Creek). John R. Campbell recovered a few ounces of gold by panning on his claims on Midnight Creek, which are leased to Clarence Zaiser.

Tolovana District.—The dredge on Livengood Creek, which was operated for the past 3 years by the Callahan Zinc-Lead Co. for the RFC on a management basis, was idle during 1954. The dredge and equipment on the property were purchased on bid by the United States Smelting, Refining & Mining Co. in October.

Olive Creek Mines recovered 857 fine ounces of gold and 87 fine ounces of silver from 72,000 cubic yards of gold-bearing gravel mined from Olive Creek between June 5 and September 18, 1954. Bulldozers dug and delivered the gravel to the sluice boxes, and a dragline removed and stacked the tailing.

Mandich, Jurich & Car operated a hydraulic placer-gold mine on Lillian Creek in 1954. No operating expenses were incurred, and the partners split the gold three ways at the close of the mining season as in the early days of Alaska mining.

Bentley Falls recovered a small quantity of gold from placer mining on ground owned by Anton Lindstrom on Wilbur Creek. A hydraulic giant thawed and stripped the overburden; and a bulldozer dug and delivered the gold-bearing gravel to sluice boxes and removed and stacked the tailing.

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The Mineral Industry of Arizona

By Frank J. Kelly,[1] William H. Kerns,[1] Breck Parker,[1] and Alfred L. Ransome [2]

BECAUSE of an overall decline in the production of metals, and, in particular, a continued decrease in the output of copper—the most important mineral produced in Arizona—the total value of mineral production (exclusive of uranium) in 1954 was 2 percent below the all-time record of $256 million reached in 1953. Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences of coverage.

Of the total value in 1954, copper contributed 88 percent. The value of the metal production was $240 million—95 percent of the total value; nonmetals $13 million—5 percent of the total; and mineral fuels (coal) $68,000—less than 1 percent.

Arizona continued to be the leading copper-producing State of the Nation, despite a 4-percent production decline in 1954. The value of output, however, decreased only 1 percent because of a higher average price for copper during the year. In the metal-minerals group, only gold and molybdenum increased in value of output in 1954. Low-grade manganese ore was shipped to depots for stockpiling. Uranium activities continued during the year, but on a considerably smaller scale than in some adjoining States.

The value of output of nonmetals as a group made an overall gain of 7 percent, headed by cement—which ranked second to copper in value. Fluorspar, mica, and pumice outputs declined sharply.

During 1954 an average of 13,700 persons was employed in the mining industry in Arizona. The 11,900 in copper mining alone represented 41 percent of the national average in 1954 for copper mining. Labor difficulties at several larger copper mines caused shutdowns during August and September.

A detailed review of the mills, smelters, and purchase depots active during 1953 was presented in the Arizona chapter in the Minerals Yearbook, volume III, 1953. There were no significant changes in 1954.

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TABLE 1.—Mineral production in Arizona, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Brucite	100	$1,250		
Clays	197,401	715,248	253,672	$814,202
Coal	5,140	32,135	10,925	68,110
Copper (recoverable content of ores, etc.)	393,525	225,883,350	377,927	222,976,930
Fluorspar	1,951	113,270	(2)	(2)
Gold (recoverable content of ores, etc.) troy ounces	112,824	3,948,840	114,809	4,018,315
Gypsum	13,484	43,824	(2)	(2)
Lead (recoverable content of ores, etc.)	9,428	2,470,136	8,385	2,297,490
Lime (open-market)	96,408	1,238,204	88,932	1,131,334
Mercury 76-pound flasks			163	43,096
Mica (scrap)	3,721	114,870	1,682	17,773
Molybdenum (content of ore and concentrate) thousand pounds	1,447	1,425,552	1,538	1,524,936
Perlite	(2)	(2)	1,296	6,990
Pumice and pumicite	123,797	425,985	80,883	125,927
Sand and gravel	3,446,821	2,680,470	3,764,080	3,067,076
Silver (recoverable content of ores, etc.) troy ounces	4,351,429	3,938,263	4,298,811	3,890,641
Stone	[3] 442,358	[3] 618,748	1,205,452	1,914,315
Tungsten concentrate 60-percent WO_3 basis	134	468,858	132	456,965
Zinc (recoverable content of ores, etc.)	27,530	6,331,900	21,461	4,635,576
Undistributed: Asbestos, barite, beryllium concentrate, cement, diatomite, feldspar, gem stones, manganese ore and concentrate (1953), silica (quartz) 1953, vanadium, vermiculite, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2)		6,165,553		6,651,954
Total Arizona		256,616,000		[4] 252,959,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers). Excludes value of low-grade manganese ore shipped to General Services Administration Purchase Depots; also excludes uranium.
[2] Value included with "Undistributed."
[3] Excludes limestone for cement and lime.
[4] The total has been adjusted to eliminate duplication in the value of stone.

TABLE 2.—Average unit value of mineral commodities in Arizona, 1953–54 [1]

Commodity		1953	1954
Clays	short ton	$3.623	$3.210
Coal	do	6.252	6.234
Copper [2]	pound	.287	.295
Gold [3]	troy ounce	35.000	35.000
Lead [2]	pound	.131	.137
Mica (scrap)	short ton	30.871	10.567
Molybdenum	Mo content, pound	.985	.992
Pumice and pumicite	short ton	3.441	1.557
Sand and gravel	do	.778	.815
Silver [4]	troy ounce	.905+	.905+
Stone	short ton	1.399	1.588
Tungsten	short-ton unit contained in 60-percent WO_3 concentrate	58.930	57.917
Zinc [2]	pound	.115	.108

[1] Prices are based on average value f. o. b. mines or mills reported by the producers, except as otherwise noted.
[2] Yearly average weighted price of all grades of primary metal sold by producers.
[3] Price under authority of Gold Reserve Act of Jan. 31, 1934.
[4] Treasury buying price for newly mined silver July 1, 1946, to date—$0.9050505 ($0.905 used in 1947 for calculating purposes).

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Of major interest to the mineral industries was the placing in operation of three new open-pit copper mines. In addition, development and construction of the surface plant at the large underground San Manuel mine were underway.

Federal Government assistance in financing exploration projects in search of reserves of strategic and critical minerals continued to be available throughout 1954; however, although 13 projects were approved in 1953 for a total of $379,000, no Defense Minerals Exploration Administration projects were written for Arizona properties during 1954.

REVIEW BY MINERAL COMMODITIES

METALS

Beryl.—Small quantities of beryl hand-sorted from pegmatite were produced in Arizona by several individuals and marketed through Beryl Ores Co., Arvada, Colo.

Copper.—Arizona continued to hold first place in copper production among the States of the United States, with an output of 377,900 short tons. This 15,600-ton decrease was 4 percent less than in 1953, but due to a higher average price the value of copper output declined only 1 percent. The value of Arizona copper output in 1953 and again in 1954 composed 87 percent of the total value of the State mineral production.

The production loss resulted primarily from the curtailment and shutdowns in August and September owing to labor strikes at several of the larger mines and permanent closing of the Castle Dome mine by the Miami Copper Co. in December 1953 because of lack of ore. Three new mines, all open-pit operations, started producing. They were the Silver Bell mine of American Smelting & Refining Co., the Lavender Pit of Phelps Dodge Corp., and Copper Cities (Porphyry Reserve) mine of Copper Cities Mining Co. Production was begun at the Silver Bell in April, at the Lavender Pit in July, and at the Copper Cities in August 1954.

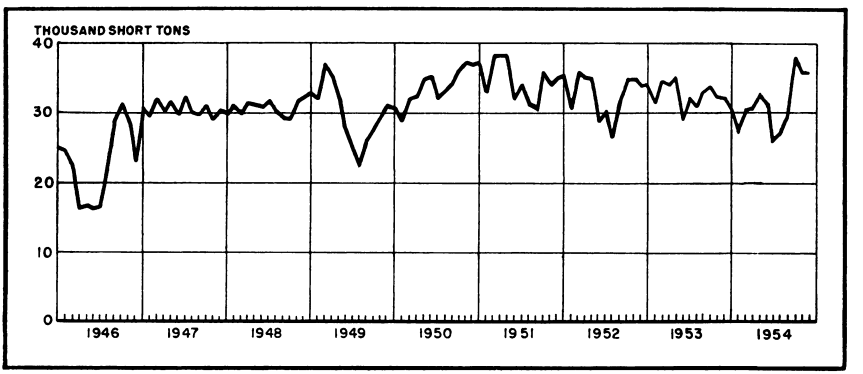

FIGURE 1.—Mine production of copper in Arizona, 1946–54, by months, in terms of recoverable metal.

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The Copper Mountain district was again the leading copper-producing area in Arizona in 1954, followed (in order of output) by Globe-Miami, Ajo, Warren (Bisbee), Mineral Creek, Pioneer, Silver Bell, Eureka, Pima, and Cochise. These 10 districts accounted for 99 percent of the 1954 Arizona copper output. Ninety-seven percent of the total State copper production came from the following 10 mines, listed in order of rank: Morenci, New Cornelia, Copper Queen-Lavender, Ray, Inspiration, Magma, Miami, Silver Bell, Bagdad, and Copper Cities.

Exploration and development were continued at the San Manuel and Pima mines in 1954. The San Manuel Copper Corp. scheduled production from the San Manuel mine for early 1956. Complete mining, milling, and smelting facilities were under construction. A planned ore output of 35,000 tons daily will make San Manuel the largest underground copper mine in the world. Exploration and development by Pima Mining Co. at the Pima mine indicated a medium-large, low-grade copper ore body that offered attractive possibilities for open-pit mining. An article [3] describing how the presence of a possible ore deposit was disclosed by geophysics was published.

Gold.—Gold production in Arizona in 1954 (114,800 fine ounces) increased 2 percent above 1953 (112,800 ounces). The rise resulted from increased recovery of gold as a byproduct from copper ore mined. Eighty-two percent of the gold output in 1954 came from this source (copper ore). Only 1 percent came from gold, gold-silver, and silver ores. The remainder was recovered chiefly from lead-zinc ores.

The Copper Queen-Lavender Pit copper mine of the Phelps Dodge Corp. in the Warren (Bisbee) district of Cochise County was the leading gold producer in Arizona in 1954, followed by the New Cornelia copper mine of the Phelps Dodge Corp. in the Ajo district, Pima County (first in 1953). In third place was the Iron King lead-zinc mine of the Shattuck Denn Mining Corp. in the Big Bug district of Yavapai County. The Magma (Magma Copper Co.), Morenci (Phelps Dodge Corp.), and Ray (Kennecott Copper Corp.) copper mines were also substantial producers of gold. These 6 mines produced 97 percent of the total gold.

Lead.—Arizona's production of recoverable lead in 1954 (8,385 short tons) declined 11 percent below 1953 (9,428 tons). This decrease was slight compared with the drop of 43 percent in 1953 (compared with 1952), when 2 large producers and many small producers of lead-zinc ore in 1952 suspended operations because of the reduction in prices of lead and zinc.

[3] Mining World, Use of Geophysics Pays Off at Pima With Disclosure of Copper Ore Body: Vol. 16 No. 11, October 1954, pp. 42–45.

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TABLE 3.—Mine production of gold, silver, copper, lead, and zinc, 1945–49 (average), 1950–54, and total, 1860–1954, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945–49 (average)	282	30	35,851,986	94,117	$3,294,109	4,240,908	$3,636,727
1950	309	24	42,709,272	118,313	4,140,955	5,325,441	4,819,793
1951	265	18	43,820,353	116,093	4,063,255	5,120,985	4,634,750
1952	187	7	45,385,327	112,355	3,932,425	4,701,330	4,254,941
1953	163	6	45,700,618	112,824	3,948,840	4,351,429	3,938,263
1954	164	5	43,460,477	114,809	4,018,315	4,298,811	3,890,641
1860–1954			[3]	11,756,893	298,986,410	330,862,970	251,815,274

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	335,355	$125,863,415	27,766	$7,737,640	52,734	$13,028,884	$153,560,776
1950	403,301	167,773,216	26,383	7,123,410	60,480	17,176,320	201,033,694
1951	415,870	201,281,080	17,394	6,018,324	52,999	19,291,636	235,289,045
1952	395,719	191,527,996	16,520	5,319,440	47,143	15,651,476	220,686,278
1953	393,525	225,883,350	9,428	2,470,136	27,530	6,331,900	242,572,489
1954	377,927	222,976,930	8,385	2,297,490	21,461	4,635,576	237,818,952
1860–1954	14,264,783	4,776,783,388	544,200	101,128,270	666,863	161,699,009	5,590,412,351

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore, old tailings, or copper precipitates shipped to smelters during the calendar year indicated.
[2] Does not include gravel washed or tonnage of precipitates shipped.
[3] Figure not available.

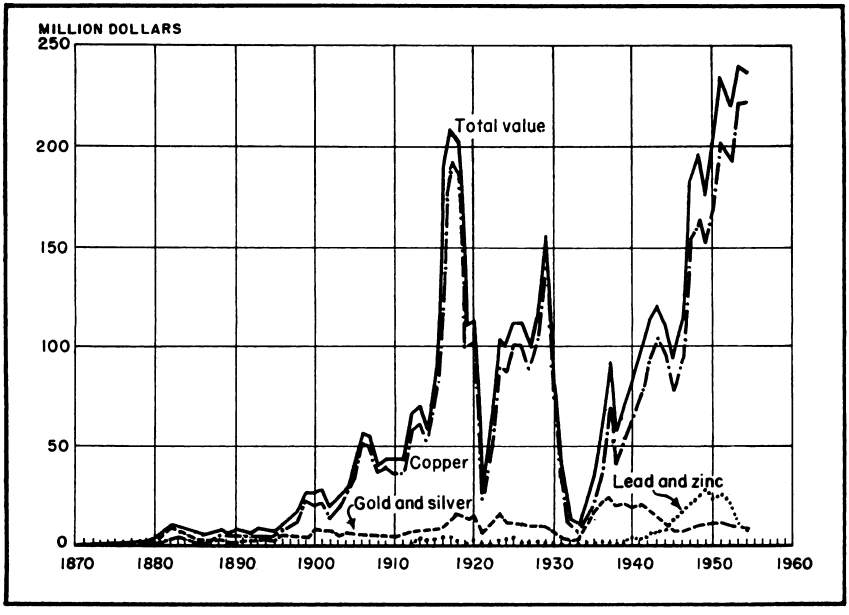

FIGURE 2.—Value of mine production of gold, silver, copper, lead, and zinc in Arizona, 1870–1954.

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TABLE 4.—Mine production of gold, silver, copper, lead, and zinc in 1954, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	8,742	340,795	30,294	634	1,817
February	9,313	330,505	27,032	708	1,772
March	10,139	365,589	30,393	681	1,813
April	9,550	365,964	30,685	714	1,773
May	9,835	374,493	32,885	754	1,878
June	10,050	374,426	31,250	785	1,870
July	7,469	286,743	25,815	814	1,837
August	8,674	336,984	27,265	737	1,725
September	8,983	359,965	29,444	698	1,754
October	10,811	397,647	37,748	653	1,689
November	10,636	376,161	37,577	601	1,790
December	10,607	389,539	37,539	606	1,743
Total	114,809	4,298,811	377,927	8,385	21,461

TABLE 5.—Gold and silver produced at placer mines, 1945–49 (average) and 1950–54, in fine ounces, in terms of recoverable metals

Year	Small-scale hand methods [1]		Gravel mechanically handled				Underground placers		Total	
			Nonfloating washing plants [2]		Bucketline and dragline dredges		Drift			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1945–49 (average)	234	16	236	39	44	10	17	(3)	531	65
1950	48	----	75	----	----	----	19	----	142	----
1951	89	----	61	11	----	----	6	----	156	11
1952	11	----	58	10	----	----	1	----	70	10
1953	60	----	----	----	49	7	----	----	109	7
1954 [4]	78	6	----	----	----	----	----	----	78	6

[1] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, rockers, dry washers, etc.

[2] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."

[3] Less than 1 ounce.

[4] Represents 5 producing mines, 1,300 cubic yards of material treated, at an average value of $2.10 per cubic yard; for similar data for years before 1953, see table 6, 1953 Minerals Yearbook, vol. III, p. 107.

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TABLE 6.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties, in terms of recoverable metals

County	Mines producing		Material sold or treated [1] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
Cochise	15	-------	2,327,154	40,375	$1,413,125	1,426,349	$1,290,918
Coconino	2	-------	360	1	35	48	43
Gila	17	-------	7,817,575	1,503	52,605	83,813	75,855
Graham	4	-------	19,318	26	910	17,156	15,527
Greenlee	3	-------	15,475,023	6,027	210,945	453,091	410,070
Maricopa	3	-------	22	2	70	28	25
Mohave	11	-------	1,828	99	3,465	2,506	2,268
Pima	24	1	11,338,480	33,336	1,166,760	630,370	570,517
Pinal	20	-------	4,924,145	14,604	511,140	843,438	763,354
Santa Cruz	20	-------	54,703	139	4,865	183,635	166,199
Yavapai	32	2	1,501,368	18,538	648,830	658,234	595,735
Yuma	13	2	501	159	5,565	143	130
Total: 1954	164	5	43,460,477	114,809	4,018,315	4,298,811	3,890,641
1953	163	6	45,700,618	112,824	3,948,840	4,351,429	3,938,263

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Cochise	43,894	$25,897,460	271	$74,254	3,620	$781,920	$29,457,677
Coconino	16	9,440	-------	-------	-------	-------	9,518
Gila	63,958	37,735,220	3	822	-------	-------	37,864,502
Graham	72	42,480	812	222,488	1,366	295,056	576,461
Greenlee	114,362	67,473,580	-------	-------	-------	-------	68,094,595
Maricopa	1	590	-------	-------	-------	-------	685
Mohave	30	17,700	2	548	51	11,016	34,997
Pima	78,716	46,442,440	4	1,096	441	95,256	48,276,069
Pinal	67,105	39,591,950	569	155,906	39	8,424	41,030,774
Santa Cruz	305	179,950	2,354	644,996	4,326	934,416	1,930,426
Yavapai	9,454	5,577,860	4,370	1,197,380	11,618	2,509,488	10,529,293
Yuma	14	8,260	-------	-------	-------	-------	13,955
Total: 1954	377,927	222,976,930	8,385	2,297,490	21,461	4,635,576	237,818,952
1953	393,525	225,883,350	9,428	2,470,136	27,530	6,331,900	242,572,489

[1] Does not include gravel washed or tonnage of precipitates shipped.

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TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1954, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	19	1,330	505	603	18,900		
Dry gold-silver	6	2,376	546	11,145	7,100	2,300	
Dry silver	17	9,093	204	67,775	32,540	2,400	
Total	41	12,799	1,255	79,523	58,540	4,700	
Copper	89	43,072,894	94,648	3,380,060	714,154,795	4,400	41,400
Copper-zinc	5	67,050	12	35,668	4,623,700	9,100	9,522,400
Lead	20	4,287	216	17,356	10,400	1,573,900	77,800
Lead-zinc	15	250,914	17,952	779,367	769,950	15,163,900	32,386,300
Zinc	3	2,727	30	1,492	75,600	700	893,000
Total	123	43,417,872	112,858	4,213,943	719,634,445	16,752,000	42,920,900
Other "lode" material:							
Old tailings, etc.[2]		29,806	618	5,339	160,200	13,300	1,100
Copper precipitates	3	24,315			36,000,815		
Total	3	54,121	618	5,339	36,161,015	13,300	1,100
Total "lode" material	164	43,484,792	114,731	4,298,805	755,854,000	16,770,000	42,922,000
Gravel (placer operations)	5		78	6			
Total, all sources	169	43,484,792	114,809	4,298,811	755,854,000	16,770,000	42,922,000

[1] Detail will not necessarily add to totals because some mines produce more than 1 class of material.
[2] Old tailings: Copper, 29,370 tons; mill cleanings: Lead, 22 tons; lead-zinc, 10 tons. Smelter cleanings: Copper, 291 tons; cleanup: Copper, 113 tons.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Material treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:						
Amalgamation [1]	(2)	8	3			
Cyanidation [1]	(2)	2,329	29,298			
Total recoverable in bullion	(2)	2,337	29,301			
Concentration and smelting of concentrates [1]	39,605,855	77,302	2,834,323	600,282,535	14,651,200	41,752,200
Direct smelting:						
Ore	697,518	34,474	1,429,842	65,598,350	2,105,500	1,168,700
Old tailings, etc.	29,806	618	5,339	160,200	13,300	1,100
Copper precipitates	24,315			[3] 36,000,815		
Total	751,639	35,092	1,435,181	101,759,365	2,118,800	1,169,800
Other: Straight leaching of copper ore [4]	3,127,298			53,812,100		
Placer		78	6			
Grand total	43,484,792	114,809	4,298,811	755,854,000	16,770,000	42,922,000

[1] Ore only; no old tailings, etc., processed by this method in 1954.
[2] Included with concentration and smelting of concentrates.
[3] Distributed as follows: Cochise County, 381,800 pounds; Gila County, 20,525,915 pounds; Greenlee County 7,838,300 pounds; Pinal County, 7,254,800 pounds.
[4] All from 1 plant in Gila County.

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TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals

A. For ore treated at mills

	Ore treated (short tons)	Recoverable in bullion		Concentrate shipped to smelters and recoverable metal					
		Gold (fine ounces)	Silver (fine ounces)	Concentrate (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Cochise	1,832,299			162,135	8,462	169,319	34,999,600	1,900	7,120,600
Gila	4,684,457			90,463	1,483	81,087	53,391,485		
Graham	19,230			4,837	25	16,894	141,000	1,607,000	2,731,100
Greenlee	15,404,024			478,833	5,796	401,056	219,511,900		
Maricopa	10	2	1						
Mohave	1,125			198		392	40,000		102,000
Pima	11,260,941			270,962	32,393	570,365	151,712,500		882,000
Pinal	4,864,493			249,737	13,515	811,310	122,677,300		
Santa Cruz	50,845			11,671	117	172,713	283,000	4,302,500	8,500,100
Yavapai	1,488,429	2,334	29,300	68,792	15,505	611,183	17,525,750	8,739,800	22,416,400
Yuma	2	1		(1)	6	4			
Total: 1954	39,605,855	2,337	29,301	1,337,628	77,302	2,834,323	600,282,535	14,651,200	41,752,200
1953	41,423,025	72	25	1,331,215	84,293	2,898,909	529,543,042	16,071,970	54,077,200
BY CLASSES OF ORE TREATED									
Dry gold	27	8	3	(1)	6	4			
Dry silver	1,000			10	3	3,568	800		
Copper:									
Ore	39,268,884			1,268,830	61,638	2,051,158	595,260,885		
Copper-zinc	83,631			16,262	9	33,104	4,179,000	9,100	8,732,800
Lead	50			5		178		1,900	
Lead-zinc	249,536	2,329	29,298	51,545	15,616	744,819	766,250	14,639,500	32,126,400
Zinc	2,727			976	30	1,492	75,600	700	893,000
Total: 1954	39,605,855	2,337	29,301	1,337,628	77,302	2,834,323	600,282,535	14,651,200	41,752,200
BY CLASSES OF CONCENTRATE SHIPPED TO SMELTERS									
Dry gold				(1)	6	4			
Copper				1,276,464	61,653	2,081,016	599,199,285		242,600
Copper-lead				127	24	5,657	29,900	69,500	8,500
Lead				19,366	14,173	645,541	430,320	13,707,825	2,836,100
Total to copper and lead plants				1,295,957	75,856	2,732,218	599,659,505	13,777,325	3,087,200
Zinc concentrate to zinc plants				41,671	1,446	102,105	623,030	873,875	38,665,000
Total: 1954				1,337,628	77,302	2,834,323	600,282,535	14,651,200	41,752,200
1953				1,331,215	84,293	2,898,909	629,543,042	16,071,970	54,077,200

See footnote at end of table.

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TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals—Continued

B. For copper ore treated by straight leaching

BY COUNTIES

	Ore treated (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Gila	3,127,298			53,812,100		
Total: 1954	3,127,298			53,812,100		
1953	3,576,794			62,816,474		

C. For material shipped directly to smelters

	Material treated (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Cochise	495,258	31,913	1,257,030	52,788,400	540,100	119,400
Coconino	360	1	48	32,000		
Gila	19,564	20	2,726	20,712,415	6,000	
Graham	88	1	262	3,000	17,000	900
Greenlee	76,407	231	52,035	9,212,100		
Maricopa	12		27	2,000		
Mohave	703	99	2,114	20,000	4,000	
Pima	77,539	941	60,005	5,719,500	8,000	
Pinal	64,412	1,089	32,128	11,532,700	1,138,000	78,000
Santa Cruz	3,858	22	10,922	327,000	405,500	151,900
Yavapai	12,939	694	17,751	1,382,250	200	819,600
Yuma	499	81	133	28,000		
Total: 1954	751,639	35,092	1,435,181	101,759,365	2,118,800	1,169,800
1953	727,198	28,350	1,452,476	94,690,484	2,784,030	982,800
BY CLASSES OF ORE, OLD TAILINGS, ETC.						
Dry gold	1,303	491	596	18,900		
Dry gold-silver	2,376	546	11,145	7,100	2,300	
Dry silver	8,093	201	64,207	31,740	2,400	
Copper:						
Ore	676,712	33,010	1,328,902	65,081,810	4,400	41,400
Cleanup, old tailings, smelter dump	29,774	585	5,060	159,000		
Precipitates	24,315			36,000,815		
Copper-zinc	3,419	3	2,564	444,700		789,600
Lead:						
Ore	4,237	216	17,178	10,400	1,572,000	77,800
Cleanup	22	1	206	900	8,000	
Lead-zinc:						
Ore	1,378	7	5,250	3,700	524,400	259,900
Mill cleanup	10	32	73	300	5,300	1,100
Total: 1954	751,639	35,092	1,435,181	101,759,365	2,118,800	1,169,800

[1] Less than 1 ton.

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TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of gross metal content

Class of material	Quantity shipped or treated (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
CONCENTRATES SHIPPED TO SMELTERS						
Dry gold	(1)	6	4	15	28	
Copper	1,276,464	62,297	2,125,578	614,549,934	594	1,584,364
Copper-lead	127	24	5,657	37,314	71,042	10,839
Lead	19,366	14,173	645,541	537,846	13,987,912	3,636,569
Total to copper and lead plants	1,295,957	76,500	2,776,780	615,125,109	14,059,576	5,231,772
Zinc concentrate to zinc plants	41,671	2,114	147,527	793,365	1,557,272	43,675,430
Total: 1954	1,337,628	78,614	2,924,307	615,918,474	15,616,848	48,907,202
1953	1,331,215	85,174	2,960,367	645,299,381	17,466,285	62,637,815
ORE TO STRAIGHT LEACHING PLANT						
Copper	3,127,298			62,368,033		
Total: 1954	3,127,298			62,368,033		
1953	3,576,794			72,595,606		
ORES, OLD TAILINGS, ETC., SHIPPED DIRECTLY TO SMELTERS						
Dry gold	1,303	491	596	19,918		
Dry gold-silver	2,376	546	11,145	7,386	3,753	1,088
Dry silver	8,093	201	64,207	32,858	3,463	
Copper:						
Ore	676,712	33,014	1,329,120	68,922,797	7,292	306,930
Cleanup, old tailings, and smelter dump	29,774	585	5,060	185,315		
Precipitates	24,315			36,604,923		
Copper-zinc	3,419	3	2,564	555,829		1,012,255
Lead:						
Ore	4,237	216	17,178	13,368	1,606,418	99,051
Mill cleanup	22	1	206	1,098	8,204	
Lead-zinc:						
Ore	1,378	7	5,250	4,634	534,928	330,662
Mill cleanup	10	32	73	418	5,377	1,432
Total: 1954	751,639	35,096	1,435,399	106,348,544	2,169,435	1,751,418
1953	727,198	28,350	1,452,476	97,891,093	2,844,247	1,563,053

[1] Less than 1 ton.

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TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties and districts, in terms of recoverable metals

County and district	Mines producing		Material sold or treated [1] (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Cochise County:													
California	1		459				441		441	900	126,900	108,000	$29,713
Cochise	1		76,880				30,857		30,857	3,894,600		7,132,000	1,947,090
Dos Cabezas & Tevis	1		84	4		4	194		194	7,500			2,529
Golden Rule (Dragoon)	1		90				4		4	2,100			624
Smelter	(2)		113	11		11	226		226	35,300			11,003
Swissheim (Elfrida)	1		102	5		5	358		358	200	23,900		3,832
Tombstone	3		70	1		1	293		293	600	6,500		1,368
Turquoise (Dragoon Mountains)	6		2,467	146		146	14,784		14,784	78,800	376,700		93,344
Warren	1		2,246,889	40,208		40,208	1,379,192		1,379,192	83,768,000	8,000		27,368,174
Coconino County:													
Coconino Plateau	1		10				11		11	4,000			1,190
Francis	1		350	1		1	37		37	28,000			8,328
Gila County:													
Banner	2		24,969	152		152	5,153		5,153	1,465,400			442,277
Dripping Springs	1		33	13		13	33		33	200	5,400		1,284
Globe-Miami	11		7,792,458	1,336		1,336	78,600		78,600	126,443,300	600		37,418,753
Green Valley	1		9	1		1	7		7	600			218
Pioneer [3]	1		67	1		1	16		16	3,200			993
Summit	1		39				4		4	3,300			977
Graham County:													
Arivaipa	2		19,275	25		25	17,140		17,140	141,000	1,624,000	2,732,000	575,527
Lone Star	2		43	1		1	16		16	3,000			934
Greenlee County:													
Ash Peak	1		6,551	193		193	50,074		50,074				52,074
Copper Mountain	2		15,468,472	5,834		5,834	403,017		403,017	228,724,000			68,042,521
Maricopa County:													
Agua Fria [4]	1		7							1,500			443
Cave Creek and Camp Creek	1		5				27		27	500			171
Goldfield	1		10	2		2	1		1				71
Mohave County:													
Cedar Valley	1		1,125				392		392	40,000		102,000	23,171
Owens	3		398	45		45	69		69	15,000			6,062
Wallapai (Chloride, Cerbat, Stockton Hill)	6		276	27		27	2,010		2,010	4,600	4,000		4,669
Weaver	1		29	27		27	35		35	400			1,095
Pima County:													
Ajo	2		9,161,615	32,708		32,708	390,104		390,104	121,587,900			37,366,274
Amole	2		161				61		61	6,200			1,884
Arivaca	3	1	96	8	2	10	1,687		1,687	100	6,000		2,729
Baboquivari	1		150	8		8	242		242	3,700			1,590
Growler	1		275	3		3	614		614	31,000			9,806
Helvetia (Rosemont) and Fresnal [5]	5		7,962	501		501	17,215		17,215	825,100	100		276,534
Meyer	1		68	7		7	109		109	2,800			1,170
Pima and Silver Bell [5]	9		2,168,153	99		99	220,338		220,338	34,975,200	1,900	882,000	10,616,082

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Pinal County:													
Bunker Hill	1		6,473	3		3	306		306	229,700			68,144
Casa Grande	2		43	1		1	27		27	2,800	200		912
Cottonwood	2		29	7		7	44		44	500			432
Crozier Peak	2		51	1		1	1,086		1,086	1,700			1,520
Mineral Creek	5		4,453,177	1,150		1,150	207,785		207,785	80,923,200	1,132,500	76,900	24,264,108
Mineral Hill	2		133	27		27	54		54	4,000			2,174
Old Hat	1		19	32		32	90		90	3,900	5,300	1,100	3,196
Picacho	1		64	1		1	13		13	4,400			1,345
Pioneer [3]	3		464,138	13,382		13,382	634,028		634,028	53,037,900			16,688,378
Red Hills	1		18				5		5	1,900			565
Santa Cruz County:													
Harshaw	3		50,108	113		113	170,665		170,665	310,000	4,270,000	8,386,800	1,740,629
Oro Blanco	2		29				96		96	300	1,500	2,800	685
Palmetto	1		370	1		1	168		168	34,600	100		10,407
Patagonia	10		2,869	8		8	6,031		6,031	246,300	33,400	108,600	94,701
Rain Mountain	1		321				342		342	8,000			2,670
Tyndall	3		1,006	17		17	6,333		6,333	10,800	403,000	153,800	81,334
Yavapai County:													
Agua Fria [4]	4		112	3		3	52		52	9,800			3,043
Big Bug	2		179,511	17,802		17,802	579,281		579,281	379,200	8,671,300	20,905,100	4,704,932
Black Rock	1		1,000	3		3	3,568		3,568	800			3,570
Bullard or Pierce	1		270	25		25	97		97	3,800			2,084
Castle Creek	3		18	1		1	10		10	1,300			428
Copper Basin		1			2	2							70
Eureka	4		1,311,051	15		15	54,251		54,251	17,676,700	2,700	2,252,700	5,507,913
Hassayampa	3	1	543	32	3	35	1,850		1,850	41,000	4,800	6,100	16,311
Peck	1		172				5,327		5,327	600			4,998
Pine Grove	1		33	1		1	43		43	1,600			546
Thumb Butte	1		45	4		4	609		609	300	3,200	2,200	1,455
Tiger	1		6	3		3	2		2				107
Tip Top	2		30	1		1	39		39	2,500			808
Verde	1		7,202	252		252	6,791		6,791	768,500			241,673
Walker and Weaver [5 6]	6		1,366	389		389	6,314		6,314	21,900	58,000	69,900	41,285
Walnut Grove	1		9	2		2							70
Yuma County:													
Castle Dome	1		(7)	6		6	4		4				214
Cienega	3		297	41		41	22		22	19,100			7,090
Ellsworth	4		59	25		25	97		97	3,900			2,113
Kofa Mountains		1			5	5		2	2				177
Plamosa and Trigo [3]	4	1	76	15	66	81	7	4	11	1,900			3,406
Weaver [6]	1		69	1		1	7		7	3,100			955
Total	164	5	43,460,477	114,731	78	114,809	4,298,805	6	4,298,811	755,854,000	16,770,000	42,922,000	237,818,952

[1] Does not include gravel washed or tonnage of precipitates shipped.
[2] Not counted as a mine, production from cleanings.
[3] Pioneer district lies in both Gila and Pinal Counties.
[4] Agua Fria district lies in both Maricopa and Yavapai Counties.
[5] Bureau of Mines not at liberty to show production figures separately by districts.
[6] Weaver district lies in both Yavapai and Yuma Counties.
[7] Byproduct of fluorspar ore.

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The Iron King lead-zinc mine in the Big Bug district (Yavapai County), operated by Shattuck-Denn Mining Corp., continued to be the leading lead producer in Arizona in 1954. As in 1953, the Flux lead-zinc mine near Patagonia in the Harshaw district ranked second, followed by the Aravaipa lead-zinc property near Klondyke in the Aravaipa district and Ray Silver Lead mine in the Mineral Creek district. The output from these 4 mines supplied 93 percent of the total lead output from Arizona in 1954.

One of the major lead producers in Arizona in 1953—Hilltop lead-zinc mine at Hilltop in the California district (operated by American Zinc, Lead & Smelting Co.)—was operated on a reduced output basis by Queen Mining Co. in 1954. No lead was recovered from the copper ore mined from the Copper Queen underground mine by Phelps Dodge Corp. in 1954.

Manganese and Manganiferous Ores.—The quantity of manganese and manganiferous ores and concentrate shipped from Arizona mines to the Government Purchasing Depots at Wenden, Ariz., and Deming, N. Mex., for stockpiling was greater in 1954 than in 1953. The value of the State manganese and manganiferous ores and concentrate shipped has increased from virtually nothing in 1952 to over $4 million in 1954. Ninety-nine percent of the ore and concentrate shipped in 1954 contained 15 to 35 percent manganese (averaged 21.64 percent) and was produced by 152 of the 174 active mining operations in Arizona in 1954. The average price paid for this material was $28.87 per long dry ton. The ore and concentrate shipped with 35 percent or more manganese content averaged 40.22 percent manganese and brought $81.95 per ton. Seventy-nine percent of the total output came from 3 of the 11 producing counties—Mohave, Yuma, and Pinal.

These shipments to Government Purchasing Depots for stockpiling and future treatment were not credited to 1954 production, but will be included in the year in which a useful product is shipped from the depot.

Mercury.—For the first time since 1951, mercury was produced in Arizona in 1954. Output was stimulated by the increase in average yearly price from $193.03 per flask in 1953 to $264.39 in 1954. Three operators in Gila County—Ord Mercury Mines, Inc., Uranium Enterprises, Inc., and C. O. Carlson—and one operator in Maricopa County—International Ore Corp.—supplied the production.

Molybdenum.—In 1954, as in 1953, all molybdenum produced in Arizona was a byproduct of copper mining by Bagdad Copper Corp., Miami Copper Co., and Morenci Branch of Phelps Dodge Corp. Total shipments of molybdenum concentrate increased from 1,367 short tons containing 1,447,000 pounds of molybdenum in 1953 to 1,444 short tons containing 1,538,000 pounds in 1954. As in past years, the Morenci mine in the Copper Mountain district, Greenlee County, was the leading producer of molybdenum in the State.

Silver.—Seventy-nine percent of the silver output in Arizona in 1954 was recovered as a byproduct from copper ore and 18 percent as a byproduct of lead-zinc mining. Of the 10 leading silver-producing mines producing 93 percent of the silver, 8 were copper and 2 lead-zinc mines. The Copper Queen-Lavender Pit copper mine continued

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to be by far the leading silver producer in Arizona; it was followed (in order of output) by the Magma copper mine, Iron King lead-zinc mine, Morenci, and New Cornelia copper mines.

Tungsten.—Production of tungsten concentrate (60-percent WO_3 equivalent) in Arizona in 1954 decreased 1 percent from the record output in 1953, which in turn was 89 percent above that in 1952.

Output in 1954 came from at least 70 and probably more individual mines and dumps in 8 counties. Three counties—Mohave, Pima, and Yavapai—supplied 80 percent of the State output. Cochise, Gila, Pinal, Maricopa, and Yuma were the five remaining producing counties. The largest producers were Dye & Batherick (Boriana dumps) in Mohave County and Black Pearl Mining Co. (Black Pearl mine) and Martin Rausch (Carlotta mine) in Yavapai County.

Uranium.—Uranium prospecting, development, and mining activities continued during the year but on a considerably smaller scale than in Utah, Colorado, or New Mexico. Major areas of activity were northern Apache County, the Cameron area of Coconino County, and the area north of Globe in Gila County.

The two major developments in the industry were completion of the mill at Shiprock, N. Mex., by Kerr-McGee Oil Industries, Inc., and installation of an upgrading plant at the Monument No. 2 mine by Vanadium Corp. of America. The Shiprock mill was completed late in the year and began processing uranium ores from the Rattlesnake and Cove areas of northeastern Apache County. The upgrading unit at Monument No. 2 was the first of its kind and was designed to beneficiate material too low in grade to economically truck to the Vanadium Corp. of America plant at Durango, Colo.

Development of the Cameron-area deposits was hampered by the long haulage distance to processing plants at Shiprock or Bluewater, N. Mex.

In Gila County a flurry of excitement was caused by the discovery of uranium minerals in fractures and bedding planes of the Dripping Springs quartzite (Precambrian) north of Globe.

Arizona's uranium-mining industry (prospecting excluded) in 1954 was estimated to include 25 operations employing approximately 300 men, of which a third were employed at the Monument No. 2 mine by the Vanadium Corp. of America.

Vanadium.—Vanadium was produced as a coproduct of uranium mining. The major producer of the metal in Arizona was the Vanadium Corp. of America at its operation in northwestern Apache County.

Zinc.—Recoverable zinc output in Arizona in 1954 declined 22 percent, compared with 1953. This decline, following a 42-percent decrease in 1953 from 1952, resulted mainly from the closing and curtailment of operations due to reduction in the price of zinc and lead. Of the total zinc produced in 1954, 75 percent was recovered from lead-zinc ore and 22 percent from copper-zinc ore.

The leading zinc-producing mines, in order of rank, were: Iron King (Shattuck Denn Mining Corp.) at Humboldt in the Big Bug district, Flux (American Smelting & Refining Co.) near Patagonia in the Harshaw district, and Republic-Mammoth (Coronado Copper & Zinc Co.) near Dragoon in the Cochise district.

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NONMETALS

Asbestos.—The output of asbestos in Arizona in 1954 reversed the downward movement started in 1953 by increasing 1,300 tons over 1953, a gain of 75 percent. The local market at the Globe Receiving Depot of General Services Administration, operated in conformance with the national stockpiling program, was the reason for increased mining activity. There were 13 operating properties in 1954, compared with 16 in 1953, but increased output from a number of larger mines more than compensated for the decreased number of producers. The average price received for all grades of asbestos dropped from $452.59 a ton in 1953 to $345.13 in 1954, owing mainly to a considerable increase in the production of grade No. 4, filter fiber, and shorts. The Western Chemical Co., working the dumps and underground mines of the old Chrysotile group, was the largest shipper. This company reactivated the mines and mill formerly operated by Johns-Manville Co. during World War II to produce shorts for the west coast market. In conjunction with this major activity, a significant quantity of grades 2 and 3 fiber was sold to the Globe Depot. Jacquays Mining Corp. was the second-ranking producer in terms of tonnage and the leading shipper of grade Nos. 1, 2, 3, and filter fibers. The Regal mine was operated throughout the year, and the crude-fiber-bearing material was trucked 47 miles to the company mill at Globe. Phillips Asbestos Mines was also an important producer, followed by Metate Asbestos Corp., Crown Asbestos Mines, Inc., and many other smaller operations, all in Gila County.

Barite.—Concentrated development work at the Granite Reef mine of Macco Corp., Arizona's only producer of barite, resulted in a threefold increase in the output of ground barite in Arizona during 1954. The crude material was trucked from the mine to the company mill at Mesa, where it was processed. The ground product was sold as a constituent of oil-well-drilling mud and for use in manufacturing glass.

Cement.—Shipments of types I and II portland cement in 1954 by the Arizona Portland Cement Co. at Rillito increased 2 percent over 1953, and the demand for cement by the construction industry in the State remained strong. Employment in 1954 reached an average of 90 men, who worked 365 days in all operations. Twenty-nine men were engaged in limestone quarrying and crushing operations; the labor of 63 men was utilized in cement, auxiliary, and administrative operations at the manufacturing plant.

Clays.—The output of all types of clay increased 29 percent in 1954 over 1953, and the industry recovered from the slump reported last year. In terms of quantity and value, bentonite (nonswelling type) continued to supply the bulk of the income to this segment of the mineral industry. The Sanders (Apache County) open-pit mine of C. A. McCarrell was the principal producer and supplied 55 percent of the total output of the State. In addition to the Sanders operation, Silicates Corp. reported producing a small quantity of bentonite from a pit in Yavapai County. The McCarrell output was shipped to a processing plant in California and used by oil refineries, and Silicates Corp. sales were used in cosmetics and pharmaceuticals.

Production of miscellaneous clay rose to 114,000 tons in 1954 and composed 45 percent of the total output for the State. All mine

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production of miscellaneous clay and 2 tons of fire clay were mined and consumed by 6 companies, which operated brick plants in Gila, Maricopa, and Pima Counties.

Diatomite.—The production of diatomite was reported in 1954 for the first time since 1946. Arizona Diatom Corp. operated the White Cliffs open-pit deposit in Pinal County for Superlite Builders Supply Co. of Phoenix. All diatomite was crushed to ⅛ inch at the mine for use as an extender in manufacturing concrete blocks.

Feldspar.—Feldspar production in 1954 remained about the same as in 1953, and the entire output for the State was consumed in manufacturing glass, pottery, and enamel. Consolidated Feldspar Department, International Minerals & Chemical Corp., continued to be the only producer of this mineral commodity, and the crude material was ground at the company mill at Kingman.

Fluorspar.—Suffering from lower prices and increased costs, the Arizona fluorspar industry continued to curtail operations. Many small mine operators closed, and output in 1954 dropped considerably below that in 1953. The Duncan (Greenlee County) mill of Arizona Eastern Fluorspar Corp. was active for only a few months at the beginning of the year; then operations ceased. Accordingly, all mine output for the remainder of the year was shipped to Deming, N. Mex., to be processed by the General Chemical Division, Allied Chemical & Dye Corp. By year end the few remaining active mines were on the verge of or had already discontinued productive activity.

Gem Stones.—Arizona continued to be one of the more important producers of gem stones in the United States. Gila County furnished the major portion of the total sales, with turquois heading the list of gem stones collected. The State produced a variety of gem or ornamental stones, including, in addition to turquois, agate, white jade. amethyst, jasper, chalcedony, and peridot.

Gypsum.—The Arizona Gypsum Corp. in Pinal County was the major producer of gypsum. All of its output was used in the production of cement. A new company (Garcia & Peters Gypsum Co.) reported the sale of a few thousand tons of agricultural gypsum in Pinal County.

Lime.—The demand for lime for treating base-metal ores and a multitude of chemical applications continued in 1954, but at a lower level, owing largely to a reduction in the quantity of base-metal ores treated. Four plants—Paul Lime Plant (Cochise County), Hoopes & Co. (Gila County), Phelps Dodge Corp. (Greenlee County), and United States Lime Products Corp. (Yavapai County)—were responsible for the entire State output. Quicklime, used mainly at copper-flotation mills and smelters, was the major type of lime produced; of the 89,000 tons of lime sold or used in Arizona in 1954, 59,000 tons was sold by producers and 30,000 tons used by the producing companies.

Lithium.—Extensive exploration and development of pegmatite deposits in Arizona were conducted during 1954. The search for minerals of economic importance centered around beryl, columbium-tantalum, and lithium. As a result of this activity, Earl and Sidney Anderson of Morristown reported discovery of a deposit of amblygonite at the Midnight Owl mine, Yavapai County. Although some production was reported, no shipments were made.

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Mica.—The output of scrap mica dropped from 3,700 tons in 1953 to 1,700 tons in 1954, reversing the upward movement noted in 1952–53. This drop can be attributed to high costs of production and shipment to west coast markets. Buckeye Mica Co. at Buckeye, Maricopa County, and Huntley Industrial Minerals, Inc., in Mohave County, continued to be the only grinding plants operating in the State. One mine in Yuma County provided the bulk of the crude production, followed by 2 mines in Maricopa, 1 in Mohave, and 1 in Yavapai. Sales of ground mica were used in manufacturing paint, roofing, and insulation.

Perlite.—Production and shipments of perlite in 1954 continued to decline and dropped 14 percent compared with 1953. Three companies were producing in 1954; two operated expanding plants. Perlite Industries of Arizona, with a mine in Pinal County and its mill in Maricopa County, continued to be the major producer. Lee's Perlite Industries operated an open-pit mine and expanding plant in Pinal County and was the second-ranking producer. The Mary T mine of Chemi-Cote Perlite Corp. in Pinal County operated for a short period in 1954. The pit was leased to Superior Industries, Inc., in December 1954, and the latter company planned to develop the property and increase mine output. Expanded perlite sold was used in plaster and concrete aggregate, with a small quantity used for insulation.

Pumice.—Utilization of scoria in manufacturing concrete aggregate and concrete blocks declined from 124,000 tons in 1953 to 81,000 tons in 1954, a drop of 35 percent. This decrease did reflect a trend in Arizona as large fluctuations are characteristic in industries so closely allied to building construction. Superlite Builders Supply Co. was the major operator, with quarries in Coconino and Yavapai Counties; all mine production was consumed at its block plant at Phoenix. The Gila Valley Block Co., Graham County, produced a small quantity of scoria in connection with its block-manufacturing activity.

Sand and Gravel.—Income to the mineral industry of the State from the quarrying, preparation, and use of sand and gravel amounted to $3.1 million in 1954; this commodity ranked sixth in terms of value of output in the State. Of the total output of 3.8 million tons, 2.6 million tons was classed as commercial production, and 1.2 million tons was Government-and-contractor output used for constructing and maintaining State highways. Maricopa County was the leading producing region, accounting for 69 percent of the total output. Pima was the second-ranking county, followed by Coconino, Navajo, Gila, Yuma, Greenlee, Pinal, Mohave, and Cochise. The five leading producers were Superior Sand & Gravel Co., Acme Materials Co., Union Rock & Materials Co., Glendale Sand & Gravel Co., and Arizona Sand & Rock Co.

Stone.—Arizona's 1954 stone production comprised 715,000 tons of crushed limestone, 78,000 tons of crushed granite, 50 tons of dimension marble, and 1,000 tons of crushed marble, 30,000 tons of dimension sandstone, and 380,000 tons of crushed miscellaneous stone and sandstone. Of the total production, 59 percent was crushed limestone from quarries in Cochise, Gila, Greenlee, Pima, and Yavapai Counties.

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The remainder was largely crushed sandstone and miscellaneous stone quarried mainly in Cochise, Coconino, Greenlee, and Yavapai Counties. The need for crushed sandstone and limestone as a flux at base-metal smelters accounted for the bulk of the stone produced in Arizona in 1954. Stone used for concrete aggregate ranked second, followed by limestone used in manufacturing cement and lime. Dimension marble and sandstone was used as a building stone and flagging.

Vermiculite.—The production of crude vermiculite in Maricopa County was reported by Phillip S. Hoyt; it was used for experimental purposes. The Ari-Zonolite Co. operated its exfoliated vermiculite plant at Glendale, Maricopa County, during 1954, and the crude vermiculite was obtained from Montana mine operators.

MINERAL FUELS

Coal.—Mines in Apache and Navajo Counties produced 10,925 tons of coal valued at $68,000.

Petroleum.—Shell Oil Co. drilled two wells in the Boundary Butte area of northeastern Apache County. The first, No. 1 Boundary Butte (sec. 6, T. 41 N., R. 29 E.), showed some gas and traces of oil from the Hermosa sandstone but was abandoned. The second well, No. 2 East Boundary Butte (sec. 3, T. 41 N., R. 28 E.), was also completed in the Hermosa sandstone and was considered a successful gas well, with production of some oil. After a suitable test period the well was shut in.

REVIEW BY COUNTIES

Apache.—Bentonite from the McCarrell open pit near Sanders continued to be the principal mineral produced in Apache County during 1954. Shipments of crude bentonite to a California processing plant reached 139,000 tons in 1954, an increase of 3 percent over 1953. On an average, 56 men were employed for 305 days in mining operations during 1954.

Twelve uranium-mining operations were reported active in the county. Largest of the State's uranium mines and one of the major producers on the Colorado Plateau was the Monument No. 2 mine operated by the Vanadium Corp. of America. The mine employed approximately 100 men in stripping and underground extraction of ore. The Plateau's first upgrading plant to treat submarginal ores was installed by Vanadium Corp. of America, and low-grade material was treated before trucking to the company mill at Durango, Colo.

Kerr-McGee Oil Industries, Inc., produced ore from its mines in the Cove area to supply the Shiprock processing mill. Ore for the mill came from company and independently-owned properties in the Cove and Rattlesnake areas of Apache County and from mines along the Arizona–New Mexico State line.

Cochise.—In 1954, Cochise produced the largest amount of gold and silver in the State, the fifth largest amount of copper and lead, and third largest amount of zinc. The combined value of output of these five metals in the county increased 35 percent above 1953.

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TABLE 12.—Value of mineral production in Arizona, 1953–54, by counties [1] [2]

County	1953	1954	Minerals produced in 1954 in order of value
Apache	$652,052	[3]	Clays, coal.
Cochise	[4] 22,713,273	$30,369,213	Copper, gold, silver, zinc, lime, stone, lead, tungsten, sand and gravel.
Coconino	[4] 519,610	179,244	Sand and gravel, stone, pumice and pumicite, copper, silver, gold.
Gila	51,746,206	39,533,953	Copper, asbestos, molybdenum, lime, silver, sand and gravel, gold, mercury, stone, tungsten, lead, clays.
Graham	[4] 726,323	591,743	Zinc, lead, copper, silver, pumice and pumicite, fluorspar, gold.
Greenlee	[4] 73,163,156	69,597,064	Copper, molybdenum, silver, lime, stone, gold, fluorspar, sand and gravel.
Maricopa	2,129,092	2,375,638	Sand and gravel, barite, clays, mercury, mica, copper, vermiculite, tungsten, gold, silver.
Mohave	[4] 439,095	263,508	Tungsten, stone, feldspar, copper, zinc, mica, gold, sand and gravel, silver, lead.
Navajo	[4] 45,091	[3]	Sand and gravel, coal.
Pima	46,081,720	54,747,243	Copper, cement, gold, sand and gravel, silver, stone, zinc, tungsten, clays, lead.
Pinal	[4] 43,380,704	41,165,484	Copper, silver, gold, lead, gypsum, sand and gravel, stone, diatomite, zinc, perlite, tungsten.
Santa Cruz	2,327,680	1,930,426	Zinc, lead, copper, silver, gold.
Yavapai	[4] 12,471,631	11,774,272	Copper, zinc, lead, stone, gold, silver, lime, molybdenum, tungsten, pumice and pumicite, mica, clays.
Yuma	163,622	78,909	Tungsten, sand and gravel, copper, gold, mica, silver.
Undistributed [5]	[4] 1,911,666	1,035,063	
Total	256,616,000	[6] 252,959,000	

[1] Value data of beryllium concentrate, gem stones, some stone (1954), some tungsten, and vanadium are excluded from county totals and included with "Undistributed" to avoid disclosure of individual company operations.
[2] Value of low-grade manganese ore shipped to General Services Administration Purchase Depots and uranium ore is excluded.
[3] Value included with "Undistributed."
[4] Revised figures.
[5] Includes value of minerals excluded from county totals (indicated by footnote reference 1) and value of minerals by county that must be concealed for particular years (indicated by footnote reference 3).
[6] The total has been adjusted to eliminate duplication in the value of stone.

The Queen Mining Co. operated the Hilltop mine in the California district formerly operated by American Zinc, Lead & Smelting Co. and shipped direct-smelting lead-zinc ore to a smelter from January through May. It was the only recorded mining activity in this district in 1954.

The Republic-Mammoth mines near Dragoon in the Cochise district were operated throughout the year by the Coronado Copper & Zinc Co. (controlled by the Cyprus Mines Corp.). A total of 76,880 tons of ore was mined, of which 1,089 tons was shipped directly to a smelter. The remaining ore mined was treated in the company 200-ton-per-day flotation mill and yielded 5,972 tons of copper concentrate and 6,932 tons of copper-zinc concentrate. The mine ranked third in zinc output and tenth in copper in the State in 1954.

The Scribner lead mine in the Swisshelm district was operated by J. W. Pursley under lease from Manhattan Consolidated Mines Development Co. in 1954. In addition to lead, smaller quantities of gold, silver, and copper were recovered.

Small quantities of gold, silver, copper, and lead were produced from three mines (Alkey Dump, Mary Jo, and Tombstone Extension) in the Tombstone district in 1954. In the Turquoise (Dragoon Mountains) district, six mines provided the gold, silver, and copper output. The value of lead recovered by direct smelting of the ore mined by Giacoma Bros. Mining Co. from the Costello group and Defiance mines represented over half of the total value of the mineral production of

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the district. The Great Western group and Tejon group mines were among the larger metal producers in the Turquoise district in 1954.

The Copper Queen (underground)-Lavender (open-pit) mine at Bisbee in the Warren district, operated by the Copper Queen Branch of Phelps Dodge Corp., continued to be the largest in Cochise County in 1954. It ranked first in gold and silver output and fourth in copper in the State in 1954. The corporation stated, in its annual report for 1954, that copper production for 1954 from the Copper Queen and Lavender mines, respectively, was 63,001,554 and 17,056,589 pounds. It reported also that 600,320 tons of copper ore was mined from the Copper Queen mine. The Lavender open-pit mine, work on which was started in 1951, reached the production stage during the year, well ahead of schedule. Test runs of ore through the new 12,000-ton-per-day concentrator were made in July and August. In all, 1,671,753 tons of ore was treated by the concentrator; 388,703 tons was treated during the tuning-up period in July and August. The concentrate was shipped by rail to the corporation's Douglas Reduction Works for smelting.

The county also ranked fourth as a tungsten producer in Arizona in 1954, as it was in 1953. At least eight tungsten-mining operations were active in the county: Standard Tungsten Corp. operation at the Tungsten King mine in the Dragoon Mountains was the largest producer.

The value of nonmetals in Cochise County in 1954 rose to $888,000, compared with $756,934 in 1953. Lime manufactured at the Paul Lime Plant at Douglas gained 41 percent over 1953 and was the most important mineral, in terms of value of output, followed by stone and a small quantity of sand and gravel. Stone-quarrying activities were centered around pits operated by Phelps Dodge Corp. (sandstone) and the Paul Lime Plant (limestone and sandstone). The sandstone was used exclusively as a flux and the limestone as a flux, in the manufacture of lime, as concrete aggregate, and as a mineral food. A small tonnage of crushed marble used in manufacturing terrazzo and as roof chips was reported by Ligier Marble Quarries.

Coconino.—The nonmetals as a group, sand and gravel, stone, and pumice, made up 95 percent of the total value of output credited to the mineral industry of Coconino County. The entire output of gravel reported in 1954 resulted from contracts let by the Federal Bureau of Public Roads. Coconino County continued to be one of the few sources of good quality dimension sandstone in the State. Rough-construction building stone, rubble, and flagging comprised the stone products used by the local building trades and California consumers.

Scoria continued to be mined at the Williams pit of Superlite Builders Supply Co. However, output in 1954 dropped to about one-fourth of the 1953 level owing to fluctuations in demand by the construction industry.

Shipments of uranium ore were made from the Cameron area to processing plants at Shiprock and Bluewater, N. Mex. Four operations were reported in the area, one of which was the Huskon properties operated by the Arrowhead Uranium Co.

Small quantities of gold, silver, and copper were produced by two mines in the county—R. E. Hayden & J. F. Erny shipped copper ore

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from the Copper Queen mine in the Coconino Plateau district, and Charles C. Lockridge shipped copper ore from the Blue Bonnet group of claims in the Francis district.

Manganese and manganiferous ore were shipped from the county in 1954 to Government Purchase Depots at Wenden, Ariz., and Deming, N. Mex., from five mines. Sixty-nine long dry tons of the ore had an average manganese content of 29.28 percent (valued at $2,705), and 389 long dry tons assayed 39.12 percent manganese (valued at $29,996).

Gila.—The value of the copper output represented 95 percent of the total for mineral production in Gila County in 1954. As a result of a 25-percent decline in 1954 (from $50 million in 1953 to $37.7 million), the county dropped from the second largest copper production in 1953 to the fourth largest in 1954. Three of the leading 10 copper-producing mines in the State—Inspiration (Inspiration Consolidated Copper Co.), Miami (Miami Copper Co.), and Porphyry Reserve (Copper Cities Mining Co.)—were in the Globe-Miami district.

Inspiration mine produced the fifth largest quantity of copper in the State in 1954. The Inspiration Consolidated Copper Co. reported that its output was 68,192,316 pounds of copper in 1954. The company mined and treated 360,623 tons of ore from the underground operations and 3,007,550 tons from the open-pit operations, a total of 3,368,173 tons, averaging 1.001 percent copper. Underground mining, which had been decreasing each year since the advent of open-pit mining, was completely suspended in August. Over the life span of the underground operations, 535 miles of underground openings was driven to produce 128 million tons of ore. Only 7½ miles of such openings remained, some of which were in use for underground haulage of open-pit ore and drainage of leaching-in-place solutions. Stripping of overburden in the open pit yielded 10,446,811 tons (3.47 tons to 1 ton of ore), of which 2,492,924 tons with a copper content of 0.31 percent, too low for treatment in the plant, was placed in dump areas where it will be available for future leaching-in-place. Labor strikes at Inspiration halted production from August 23 to September 19.

The Miami mine of the Miami Copper Co., second-ranking copper producer in Gila County and seventh in the State, produced 44,940,161 pounds of copper in 1954, according to its annual report for 1954. Work preparatory to mining of the low-grade ore body had progressed to the point where some production was possible in March 1954, with gradual expansion for the remainder of the year. Of the total tonnage mined, 23 percent was derived from the low-grade ore body. Acid leaching of the residue overlying the previously mined areas, followed by precipitation with iron, contributed 15 percent of the total output. Since this procedure was begun in 1942, 61,132,580 pounds of copper has been so recovered. There was a small production from the treatment of copper hydroxide precipitates formed in treating water for industrial use. From re-treatment of the sulfide copper concentrate obtained by flotation, 422,592 pounds of molybdenum was recovered.

The production of copper from the Castle Dome property of the Castle Dome Copper Co., a wholly owned subsidiary of the Miami Copper Co., was limited to copper recovered from leaching mine dumps. Castle Dome had been a large, steady copper producer for many years until operations ceased on December 4, 1953. Disman-

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tling of the Castle Dome plant, begun in December 1953, continued in 1954. Transportation and installation at the Copper Cities (Porphyry Reserve) mine operated by Copper Cities Mining Co., a subsidiary of Miami Copper Co., by August 2, 1954, had reached the stage where partial production was possible. Except for a 4-week strike, beginning in August and extending into September, at Copper Cities (as well as Miami) gradual increase was realized until full production was attained in November 1954. Despite this fact, this operation ranked as the third-ranking copper producer in the county and tenth-ranking in the State in 1954. The company reported that 7,257,380 tons of overburden was stripped and 996,160 tons of ore was mined and concentrated with an average content of 0.783 percent copper, from which 12,514,108 pounds of copper was recovered. In addition, moderate quantities of gold and silver were recovered from the ore.

A total of 5,811 long dry tons of ore averaging 25.59 percent manganese and valued at $182,394 was shipped by 23 operations in the county to the Government Purchasing Depot at Wenden in 1954. The Globe, Magnet, New Doughboy, and Silver Glance mines were the largest producers.

Asbestos, lime, sand and gravel, stone, and clays comprising the nonmetals group comprised only 3 percent of the total value of mineral production in Gila County for 1954. The county continued to be the only asbestos-producing area in Arizona; and output in 1954, as in past years, came from 13 mines and 8 mills near Globe. The bulk of the sales was in grade Nos. 4, 5, and 7 and filter fiber, although production of grades Nos. 1, 2, and 3 for the stockpiling program continued. In 1954 companies operating plants that processed asbestos-bearing rock included Western Chemical Co., Jaquays Mining Corp., Phillips Asbestos Mines, Metate Asbestos Corp., and Crown Asbestos Mines, Inc.

Lime, the second most important nonmetal, continued to be produced at the Globe plant of Hoopes & Co. All sales were chemical lime, used mainly as a reagent in milling copper ore. Of the total sand and gravel produced, 59,000 tons was produced by the Gila County Highway Department from pits near Globe. The remainder was classed as commercial output—used largely for building construction—from a pit owned and operated by Hagen Construction Co., Inc. The remainder of the county nonmetallic output was mainly limestone used in manufacturing lime and a small quantity of dimension sandstone used as building stone.

Mercury was reported produced by three operations (Ord Mercury Mines, Inc., Uranium Enterprises, Inc., and C. O. Carlson) in Gila County in 1954 and sold to Mefford Chemical Co. and Braun Corp. The output was stimulated by the increased price for mercury in 1954. A small quantity of tungsten concentrate (60-percent WO_3 equivalent) was produced by El Oso Mines, Keith Owens, and P. J. Harrison from mines in the county in 1954.

Graham.—Lead-zinc ore from the Aravaipa group of the Athletic Mining Co. in the Aravaipa district continued to be the main source of the value of minerals produced in Graham County in 1954. The combined value of the lead and zinc output was 87 percent of the total for all minerals produced. The Athletic Mining Co. continued to

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operate its 100-ton-per-day flotation mill. The company reported that 19,230 tons of ore was treated to yield 1,921 tons of lead concentrate and 2,916 tons of zinc concentrate, which together contained 30 fine ounces of gold, 20,158 ounces of silver, 227,538 pounds of copper, 1,860,976 pounds of lead, and 3,206,926 pounds of zinc. This mine ranked third in lead production in Arizona in 1954 and fourth in zinc.

Production of nonmetals in Graham County dropped considerably below that reported in 1953, due largely to the lower demand for fluorspar and the erratic requirements for scoria used in concrete aggregate for building construction and the manufacture of concrete blocks. A small tonnage of crude fluorspar was mined by the Spar Mining Co. at Fort Thomas, and scoria was quarried by the Gila Valley Block Co. from a deposit near Safford.

Some manganese and manganiferous ore were shipped from deposits in the county to the Government Purchase Depot at Deming, N. Mex.

Greenlee.—Greenlee County, with a $67,473,580 value of copper production in 1954, a decline from $71,054,886 in 1953, continued to be the chief copper-producing area in Arizona. Copper accounted for 97 percent of the value of the mineral production of the county. The Morenci mine of the Phelps Dodge Corp. remained the outstanding producer of copper in Arizona and ranked first in molybdenum, fifth in gold, and fourth in silver.

The Phelps Dodge Corp. stated in its annual report for 1954 that the total tonnage removed from the Morenci open-pit mine in 1954 was 47,165,323 tons; of this, 15,427,147 tons was ore and 31,738,176 tons waste and leach material. The ratio of waste and leach material to ore was 2.06, compared with 1.86 in 1953. The 45,000-ton-per-day Morenci concentrator treated 15,404,024 tons of ore, and 478,720 tons of concentrate was smelted. According to the company report, copper produced from the Morenci mine in 1954 totaled 229,477,326 pounds, compared with 248,358,787 pounds in 1953; 849 tons of molybdenite concentrate was produced as a byproduct of the copper concentrate.

During 1954 Charles E. Stevens mined 5,325 tons of copper ore from the Molinar-Alaska mine in the Copper Mountain district and shipped it to the El Paso copper smelter. In the Ash Peak district, the Ash Peak Lease shipped 6,551 tons of ore from the Ash Peak mine, from which a substantial quantity of silver and some gold were recovered.

In the nonmetallic field the mineral industry of the county reported the production of lime, stone, fluorspar, and sand and gravel; sales in 1954 ($581,000) remained relatively the same as in 1953. In terms of value, lime was the most important commodity, and the county ranked first in the State in the production of lime.

In addition to lime, large quantities of crushed sandstone used as a flux and crushed limestone used in the manufacture of lime were produced by Phelps Dodge Corp. in connection with its copper-mining operations. Greenlee County was also the leading shipper of fluorspar in the State; and, despite a drop in output of crude fluorspar in the State, county production increased. This gain,

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however, was not due to renewed mining activity but to shipments from stocks of crude and ground material.

Maricopa.—Of the total value of mineral production in Maricopa County during 1954, $2.36 million (99 percent) was nonmetals. In terms of value of output, sand and gravel continued to be the most important mineral commodity. Production in 1954 amounted to 2.6 million tons, of which 556,000 tons was produced by private contractors for the county and city road departments and the Federal Bureau of Public Roads and construction and maintenance crews of the respective agencies. The remaining 2 million tons was quarried, prepared, and sold by commercial producers and used largely in building construction. The principal commercial producers were Superior Sand & Gravel Co., Acme Materials Co., Union Rock & Materials Co., Glendale Sand & Gravel Co., and Arizona Sand & Rock Co.

In 1954, as in 1953, the Granite Reef mine of the Macco Corp. was the only producer of barite in Airzona. Crude barite was trucked from the mine near Granite Reef to the corporation mill at Mesa. Output in 1954 was 2½ times the 1953 total, which in turn was 72 percent below that in 1952. The erratic nature of production was not due to a fluctuating demand for barite but rather to the nature of mining and processing this commodity in the State.

Clays produced in the county consisted mainly of miscellaneous clay used in manufacturing building brick and other structural clay products; the output of raw clay continued to climb, increasing 82 percent over 1953. Wallapai Brick & Clay Products, Inc. and Western Clay Products Co., Inc., both of Phoenix, continued to be the only mine operators. A third company, Phoenix Brick Yard, was active in manufacturing brick but operated solely on clay purchased from out-of-State sources.

The output of crude and ground mica in Maricopa County dropped considerably below that in 1953, and only two operators reported mine production during part of 1954. All the crude mica was shipped to the Buckeye plant of the Buckeye Mica Co., where it was ground and sold to west coast consumers for use in paint, for roofing, and as insulating material.

A small tonnage of crude vermiculite was produced in the county by Phillip S. Hoyt and used for experimental purposes, and the Ari-Zonolite Co. operated its Glendale exfoliated vermiculite plant on crude material mined in Montana.

The metals produced in the county in 1954, listed in order in terms of value of output, were mercury, copper, tungsten, gold, and silver. One mine—Pine Mountain—operated by International Ore Corp., supplied the entire mercury production. Copper ore was shipped from the Jack Pot mine in the Agua Fria district and Go-John mine in the Cave Creek and Camp Creek districts during 1954. Kenneth W. Hebner recovered a few ounces of gold and silver by amalgamating the ore from the Gold Nugget mine in the Goldfield district. Tungsten output came from the Tough Nut mine, operated by Savage & Berry.

The manganese ore mined and shipped from at least 30 operations in the county in 1954 was valued at $500,000. This represented 13,000 long dry tons of ore with an average manganese content of 24.89

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percent. This output was shipped to the Government Purchase Depot at Wenden, Ariz., for the National Stockpile of low-grade manganese ore.

Mohave.—Manganese- and manganiferous-ore mining was an important component of the mineral industry to Mohave County in 1954. The county ranked first in the quantity of ore shipped to the Government Purchase Depots at Wenden, Ariz., and Deming, N. Mex. A total of 55,714 long dry tons of ore averaging 19.72 percent manganese and 28 tons averaging 39.18 percent, with a combined value of $1,380,000, was shipped from 24 mines in the county in 1954. The bulk of the ore shipped came from the Lake, Love, Maggie, McGregor, and Priceless mines.

Tungsten was produced from 9 operations in Mohave County in 1954; the value of output was 53 percent of the total value of the mineral production. Three of the largest tungsten producers in the county were Dye & Bathrick from the Boriana dumps, A. D. Allen from the Boriana mine, and Williams Tungsten from the Wothree Mines.

Stone, feldspar, mica, and sand and gravel were the nonmetals produced in Mohave County in 1954, and the value of these minerals represented 34 percent of the total value of output for the region. Silica (quartz) was the only stone reported; it was quarried by International Minerals & Chemical Corp. pit near Kingman. All output was shipped to west coast markets and used in manufacturing porcelain and pottery. In connection with its silica-mining operations, International Minerals & Chemical Corp. continued to mine, process, and sell feldspar from its Kingman properties. The grinding plant near the mine employed 10 men for 320 days as well as 8 men working 320 days at the mine.

Activity in the mica field consisted of mining at the Mica Hill mine by Huntley Industrial Minerals, Inc., and operation of the company grinding plant at Kingman. All output was shipped to west coast markets and used in manufacturing of paint.

A small quantity of commercial gravel was produced by John Osterman and consisted of structural and paving gravel consumed by the local building trades.

The combined value of the gold, silver, copper, lead, and zinc output in the county dropped from $279,672 in 1953 to $34,997 in 1954. The decline resulted from cessation of operations at the Antler mine by the Yucca Mining & Milling Co., Inc., formerly 1 of the 2 leading producers in the county, and curtailment of output at the other important operation, Copper World mine, by Copper World Mining Co. In addition to the Copper World, 10 other gold, silver, copper, lead, or zinc mines were active in the county.

Pima.—Copper mining at Ajo continued to be the most important part of the mineral industry in Pima County, and the value of the copper output was 85 percent of the total value of county mineral production. The value of the copper production increased 21 percent above that in 1953, which was the main cause of a 19-percent gain in the total value of mineral output in the county in 1954. Four mines—New Cornelia (Phelps Dodge Corp.), Silver Bell (American Smelting & Refining Co.), Mineral Hill-Daisy (Banner Mining Co.), and Alpha (Pima Mining Co.)—produced 99 percent of the copper

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output in the county and 21 percent of the copper output in the State.

According to the annual report for 1954 by Phelps Dodge Corp., material mined from the New Cornelia open-pit mine at Ajo totaled 22,859,274 tons, including 9,128,833 tons of ore and 13,730,441 tons of waste. The ratio of waste to ore was 1.50 : 1, compared with 1.53 : 1 in 1953. The corporation 30,000-ton-per-day concentrator treated 9,132,233 tons of ore during the year and the smelter, 209,409 tons of concentrate. The corporation reported that the copper production for 1954 from the New Cornelia mine was 123,170,133 pounds, compared with 130,983,013 pounds in 1953.

The Silver Bell mine, second-ranking copper producer in the county and eighth in the State, operated by the American Smelting & Refining Co., was a new producer in 1954. The entire year of 1953 had been spent removing waste preparatory to open-pit mining and in erecting a 7,500-ton-per-day flotation mill. Ore reserves were estimated at 32 million tons when mining of the ore was begun.

The Mineral Hill-Daisy and Alpha mines, third- and fourth-ranking copper producers in the county, were operated throughout 1954. The Banner Mining Co. completed a 450-ton-per-day flotation mill (Mineral Hill) that went into operation May 1, 1954. The Pima Mining Co. had no milling facilities at the Alpha (Pima) mine; ore was shipped directly to the El Paso and Hayden copper smelters.

Cement was the leading nonmetal in Pima County in 1954, and the cement plant at Rillito owned and operated by the Arizona Portland Cement Co. operated throughout 1954; shipments were 2 percent greater than in 1953.

Demand for construction materials by the building trades in the county were felt by the sand and gravel, stone, and clay segments of the mineral industry, and significant gains were reported for each commodity in 1954. Of the 683,000 tons of sand and gravel produced, only 185,000 tons was produced by construction and maintenance crews of the county highway department and contractors for the Army Corps of Engineers. The major commercial producers, who supplied 72 percent of the total output, were Tucson Rock & Sand Co., L. M. White Contracting Co., and San Xavier Rock & Sand Co. Limestone used in manufacturing cement comprised the bulk of the output of this commodity, but small quantities of dimension marble produced by Hermosa Stone Co., Inc., and crushed quartzite used as a fluxing medium by Richard Ballesteras were also reported.

Brick companies, in addition to operating plants manufacturing building brick and other structural clay products, produced all the clay mined in Pima County in 1954.

Miscellaneous clay was the only type of clay mined and the largest producers in order of importance were Grabe Brick Co., Tucson Pressed Brick Co., and Louis De Vry & Son, all of Tucson.

The New Cornelia mine was the principal producer of gold in the county and ranked second in the State. The gold was recovered as a byproduct of copper ore. Silver also was recovered from this ore and, along with that from the Silver Bell and Mineral Hill-Daisy mines, accounted for 94 percent of the silver output in the county in 1954. Zinc output came from the Atlas mine operated by B. S. & K. Mining Co. in 1954; 500 tons of zinc was contained in the zinc con-

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centrate recovered from 2,693 tons of zinc ore treated in the company 100-ton-per-day flotation mill.

Tungsten concentrate valued at $84,289 was produced from at least 20 and possibly more operations in the county in 1954. The three largest producers were Scheely Mining Co. (from the Scheely group of claims), W. H. Coplen (from the San Juan mine), and J. E. Thornton, J. E. Casey & Meyers (from the Jezebel No. 1). Manganese and manganiferous ore were shipped by a number of operations to the low-grade National Stockpile Purchase Depot at Wenden, Ariz.

Pinal.—In 1954 Pinal County ranked fourth in gold output, second in silver, third in copper, and fourth in lead, among the counties of Arizona. The value of copper production was 96 percent of the total value of the mineral output in the county. The 5-percent drop in the total value of the minerals produced reflected directly the decline in copper output. The leading producers of copper were Ray mine (operated by Kennecott Copper Corp.), which ranked fourth as a producer of copper in the State, and Magma mine (operated by Magma Copper Co), which ranked sixth. Mine development and surface-plant construction at the San Manuel mine, operated by a subsidiary of Magma Copper Co., continued.

In the Kennecott Copper Corp. annual report for 1954, copper production from the Ray mines was given as 40,259 tons, compared with 47,246 tons in 1953. A total of 4,425,120 tons of ore was mined and milled in 1954, compared with 5,567,150 tons in 1953. The lower production in 1954 was due to reduced domestic demand for copper in the early part of the year and work stoppages later. In March, operations were reduced to a 5-day, 40-hour-week basis. A 2-week labor strike occurred in August, reducing the output further. The reduction of the workweek from 48 to 40 hours effected an important savings in overtime payments, so that later in the year, when higher production rates were resumed, the 40-hour week was maintained by revising working schedules and hiring additional personnel. Conversion of the Ray Mines Division from an underground to an open-pit mine was virtually completed in 1954. According to the corporation, as a result of this conversion operating costs were reduced, productive capacity was increased, and the life of the mine was extended. The conversion involved removing 43 million tons of overburden. The caved areas of the underground mine will be leached, with resulting increased production of low-cost precipitate copper. During the year, to improve the transportation facilities, four 50-ton twin-diesel trucks were added to the fleet, which was previously comprised of trucks of 35-ton capacity. At the concentrating plant, new and larger ball-mill motors were being installed to increase the mill speed, which would permit either a 10-percent increase in the quantity of ore ground, or finer grinding and improved recovery.

Magma produced 54,185,953 pounds of copper in 1954, compared with 49,637,988 pounds in 1953, according to the Magma Copper Co. annual report for 1954. The average price received by the company for copper in 1954 was 29.63 cents per pound, compared with 28.87 cents in 1953. The company reported that 433,073 tons of milling ore and 30,842 tons of smelting ore were produced from the Magma mine in 1954. In addition to the copper, 12,024 fine ounces of gold and 623,806 ounces of silver were recovered. Exploration and de-

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velopment in 1954 at the Magma operation included 10,878 feet of drifts and crosscuts, 4,812 feet of raises, 98 feet of shafts, and 7,886 feet of diamond drilling.

The Ray Silver-Lead mine, operated by G. R. French, was the principal producer of lead in the county and ranked fourth in the State in 1954. Output of lead ore from this mine increased from 549 tons in 1953 to 2,432 tons in 1954, which accounted mainly for the sevenfold increase in lead output in the county in 1954.

In addition to the 2 copper and 1 lead mine described, 17 other mines produced various combinations and quantities of gold, silver, copper, lead, and zinc in the county in 1954. A small quantity of tungsten was produced by two individuals—P. Salas and H. E. Carter, and by the White Mountain Mining & Milling Co. Manganese and manganiferous ore valued at $650,000 were shipped from 14 mining operations in the county in 1954 to the Government Purchase Depots at Wenden, Ariz., and Deming, N. Mex., under the low-grade manganese-ore stockpiling program.

Although Pinal County was the source of all the gypsum and perlite produced in Arizona, nonmetals supplied less than 1 percent of the total value of mineral production. The production of gypsum continued to increase owing to the demand for this commodity for use in manufacturing cement, and the Arizona Gypsum Corp., the only producer in the State, employed 6 men for 249 days in mining operations. Although the demand for perlite in the United States remained strong, the output in Arizona declined slightly.

Diatomite was mined in Pinal County for the first time in 1954 by Superlite Builders Supply Co. at its property near Mammoth. The crude material was trucked to the company block plant at Phoenix, where it was used in manufacturing concrete blocks.

All sand and gravel was classified as commercial output and was sold on the local market for building and other structural purposes, and all the stone sold in 1954 was quarried by the Coolidge Sand & Rock Co. and used in concrete aggregate.

Santa Cruz.—Output of the metals, gold, silver, copper, lead, and zinc composed the entire mineral output of Santa Cruz County in 1954. Production of each of these minerals decreased in 1954, compared with 1953. The county ranked second in value of output among the counties in the State in lead and zinc in 1954. The Flux mine, operated by the American Smelting & Refining Co., was the important lead-zinc producer in the county and the second-ranking lead and zinc producer in the State in 1954, the Iron King mine in Yavapai County being first. The Flux mine was operated continuously throughout the year. A total of 49,509 tons of lead-zinc ore was mined and milled in the company 200-ton flotation mill to produce lead and zinc concentrates which were shipped to the American Smelting & Refining El Paso lead smelter and Amarillo and Corpus Christi zinc smelters, respectively. In addition to lead and zinc, a substantial quantity of copper and moderate quantities of silver and gold were recovered as byproducts. Nineteen other mines in the county produced ores of gold, silver, copper, lead, and zinc in 1954. Of these operations, the largest output was reported from the Duquesne group of claims operated by 10 lessees, Vulcan, Three R, Santo Nino, and Glove Group mines.

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Manganese and manganiferous ore was shipped from six mines in the county in 1954 to the Government Purchase Depots at Wenden, Ariz., and Deming, N. Mex. The two mines with the largest output were the Enterprise, operated by Rupert Beyerle, and Mona Prieta, operated by Mars Marketing Co.

Yavapai.—In 1954 Yavapai County was the leading producer of lead, zinc, and tungsten in Arizona and ranked third in gold, silver, and molybdenum output and sixth in copper production. Stone, lime, scoria (pumice and pumicite), clays, and mica were also produced in the county.

The value of the copper-lead-zinc output composed 79 percent of the total value of mineral output in the county in 1954. The Shattuck Denn Mining Corp. Iron King mine, the leading lead and zinc producer in the State, accounted for the largest part of the output of lead and zinc in the county. The corporation mined and milled 179,485 tons of lead-zinc ore, from which 2,320 fine ounces of gold and 28,994 ounces of silver were recovered by cyanidation and 14,178 tons of lead concentrate and 20,971 tons of zinc concentrate by flotation. A total of 16,064 ounces of gold, 585,379 ounces of silver, 235 tons of copper, 4,610 tons of lead, and 12,003 tons of zinc was contained in the concentrate smelted.

The Bagdad open pit, ninth-ranking copper producer in Arizona, was operated all year by Bagdad Copper Corp. and was one of the important producers in the county in 1954. A total of 1,300,454 tons of copper ore was mined from the open pit and treated in the company 4,000-ton-per-day flotation-concentration mill. Molybdenum and silver were recovered from the copper ore as byproducts. An article[4] describing the streamlined mining and improved haulage at Bagdad was published.

The second-ranking zinc producer in the county and the fifth in the State—Old Dick mine—was operated throughout 1954 by Manhattan Consolidated Mines Development Co. Copper-zinc ore was mined and treated in the company mill, where copper and zinc concentrates were produced for shipment to a smelter. In addition, some direct-smelting copper and copper-zinc ores were mined and shipped.

In addition to the 3 mines described, 29 other mines in the county produced various quantities of gold, silver, copper, lead, and zinc in 1954. A small quantity of gold was recovered from two small placer-mining operations. Tungsten was produced from eight mines in Yavapai County in 1954. The three largest producers were Black Pearl (Black Pearl Mining Co.), Carlotta (Martin Rausch), and Tungstona (Hillside Mining & Milling Co.).

Manganese and manganiferous ore shipped by 13 individual operators from mines in the county in 1954 had a total value of $100,000. The ore shipped comprised 2,585 long dry tons averaging 21.72 percent contained manganese and 182 long dry tons that assayed 50.08 percent manganese.

Stone was the most important nonmetal mineral commodity in Yavapai County in 1954, and output jumped from 3,000 tons in 1953 to 202,000 tons in 1954. Crushed granite and miscellaneous stone used in concrete aggregate composed the bulk of the output, followed

[4] Mining World, This Is What Streamlined Mining and Improved Haulage Did for Bagdad: Vol. 16, August 1954, pp. 40-43.

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by dimension sandstone used for flagging and crushed limestone used in manufacturing lime. The larger producers included W. R. Skousen (miscellaneous), W. J. Henson (granite), Arizona Quarry & Stone Co. (limestone), and Dunbar Stone Co., Richard Terrell, and Ulmer's Quarry (sandstone).

Lime, produced by the Grand Canyon Lime & Cement Co. at Nelson, was the second-ranking nonmetal, and output remained at relatively the same level as that reported in 1953. The bulk of the sales was quicklime used for ore concentration, but some quicklime was used in manufacturing insecticides and open-hearth furnaces, whereas the hydrated lime sold was used mainly in the manufacturing and chemical industries.

Volcanic scoria (pumice and pumicite) required in manufacturing concrete blocks was produced in 1954, and 2 men were employed 260 days in mining operations near Ashfork. Scrap mica was mined at the Dixie Queen mine by Floyd Kent, and the crude material was shipped to Buckeye for grinding and ultimate sale on the west coast market.

Yuma.—In 1954 Yuma County was second to Mohave in production of manganese ore. Forty operations shipped 40,189 long dry tons of manganese ore with an average manganese content of 19.6 percent to the Government Purchase Depot at Wenden, Ariz. This ore had a value of $1,047,000. In addition, 1 small lot of ore averaging 41.35 percent manganese was shipped to the depot. Of the 41 operations, the 6 leading producers of ore in the county were Manganese Co. of Arizona (Black Bird), Manganese Co. of California (Black Crow), Todd & Allen (Black Diamond), Al Stovall (Doyle), Noah & J. F. Power (Power No. 1–3), and R. Hare, D. Fisher & P. T. Evans (Spring).

In contrast with 1953, when nonmetals composed 62 percent of the total value of mineral production, this group only represented 37 percent in 1954. The drop in value from $101,000 to $29,000 was due largely to the lack of any productive activity at the county fluorspar mines. The only factor that prevented a more drastic decline was the output of 29,000 tons of commercial sand and gravel and an increase in the production of scrap mica shipped to Buckeye for grinding.

The value of tungsten output from the 14 active mining operations in the county represented 45 percent of the total value of the mineral output. All except 1—Tunghill (operated by J. J. Stetler & Paxton)—were small producers with an output of less than 100 units of WO_3.

In 1954 small quantities of gold, silver, and copper were recovered from 81 tons of gold ore, 5 tons of silver ore, and 415 tons of copper ore mined from 13 mines in Yuma County. Some gold and silver came from two placer mines in the county.

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The Mineral Industry of Arkansas

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Division of Geology, Arkansas Resources and Development Commission.

By Robert S. Sanford,[1] Norman F. Williams,[2] and Harvard Eng[3]

THE 1954 VALUE of mineral production in Arkansas was a record $132 million, a 5-percent increase over the $127 million value for 1953. Twelve minerals and five mineral fuels were produced in Arkansas in 1954. Petroleum ranked first, followed by bauxite, sand and gravel, LP-gases, and stone, in the order of their importance. Although barite production decreased in 1954, Arkansas remained the leading producer in the United States. Domestic bauxite production continued to increase in 1954. Important quantities of coal, natural gas, and cement were also produced. The mineral fuels furnished 69 percent of the total mineral value; nonmetals supplied 18 percent and metals 13 percent.

TABLE 1.—Mineral production of Arkansas, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Barite	380,763	$3,945,583	370,621	[2] $3,488,483
Bauxite, long tons, dried equivalent	1,529,976	12,975,992	1,949,368	15,993,887
Clays	529,126	1,734,414	617,450	2,556,367
Coal	775,207	6,143,757	477,268	3,589,217
Iron ore (usable), long tons, gross weight	254	(3)	716	(3)
Manganese ore (35 percent or more Mn), gross weight	6,123	526,647	13,728	1,020,752
Natural gas, million cubic feet	41,510	2,200,000	33,471	1,841,000
Natural-gas liquids:				
Natural gasoline and cycle products, thous. gal	58,422	4,123,000	50,778	3,234,000
LP-gases, do	55,188	2,562,000	58,506	2,521,000
Petroleum (crude), thousand 42-gallon barrels	29,681	77,170,000	[4] 29,130	[4] 79,520,000
Sand and gravel	4,903,835	4,955,383	6,611,860	6,566,806
Slate	34,516	315,858	41,845	379,076
Stone	[5] 3,545,350	[5] 5,069,750	4,604,067	5,929,638
Undistributed: Abrasive stones, cement, gypsum, lime, soapstone, stone (crushed granite, miscellaneous, 1954), recovered elemental sulfur, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)	----------	[5] 5,367,669	----------	5,742,325
Total Arkansas	----------	127,090,000	----------	[6] 131,745,000

[1] Production as measured by mine shipments or mine sales (including consumption by producers).
[2] Value partly estimated.
[3] Value included with "Undistributed."
[4] Final figure. Supersedes preliminary figure given in commodity chapter.
[5] Excludes limestone for cement and lime.
[6] The total has been adjused to eliminate duplication in the value of clays and stone.

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Some of the production data for 1954 were collected jointly with the Bureau of the Census, United States Department of Commerce. Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences of coverage.

DMEA AND DMPA CONTRACTS IN ARKANSAS

Two applications for Defense Minerals Exploration Administration (DMEA) assistance for diamond exploration in Pike County were reviewed by the Washington Office. These applications were denied. One DMEA application for manganese exploration in Independence County was pending.

EMPLOYMENT, ACCIDENTS, AND WAGES IN MINERAL INDUSTRIES

Employment.—The average annual employment in the mineral industries in 1954 was 6,181, a 7-percent decrease from 1953. Metal-mining employment decreased 2 percent to an average of 905; nonmetal employment decreased 4 percent to an average of 1,845; and coal-mining employment decreased 46 percent to an average of 464. The 1954 annual average of persons employed in the crude-petroleum and natural-gas-extraction industries was 2,967, an increase of 1 percent from that of 1953.

Accidents.—There were no fatal accidents in the petroleum industry and none in metal mining and smelting during 1954. One fatal accident occurred in the nonmetal industry.

Wages.—The average weekly wage in the metal-mining industry was $76.14, a decrease of 4 percent from 1953, and in the nonmetal industry the average weekly wage was $66.45, a decrease of 3 percent. The average weekly wage in the coal industry increased 9 percent to $66.46. The petroleum industry average weekly wage was $81.96, an increase of 5 percent from 1953.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Production of coal in Arkansas in 1954 followed the national trend and declined to 477,300 short tons valued at $3.6 million, compared with 775,200 short tons valued at $6.1 million in 1953. Production was obtained from 57 mines, of which 38 were underground and 19 open-pit operations. This was 15 mines less than in 1953. Production from strip mines was slightly larger than from underground mines. Coal was produced in Sebastian, Franklin, Johnson, Logan, and Pope Counties. The average number of days worked in 1954 for all of the coal mines was 97, a decrease of 11 days from the 1953 average.[4]

Natural Gas.—The Arkansas natural-gas industry was vitally affected by the Supreme Court of the United States ruling on sales of natural gas through interstate pipelines. Industry marked time

[4] Fitzjarrell, J. W., Annual Report of the State Inspector of Coal Mines, State of Arkansas: 1954, pp. 5-12.

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awaiting clarification and revision of the natural-gas law. Application of the regulations will tend to promote development of industries that depend on natural gas as a fuel or as a raw material within the boundary of the producing State and tend to restrict shipments of natural gas to other States. Marketed production of natural gas in Arkansas declined 19 percent in 1954 to 33,471 million cubic feet, and the value decreased 16 percent to $1.8 million, compared with sales of 41,500 million cubic feet valued at $2.2 million in 1953. Estimated proved recoverable reserves of natural gas at the end of 1954 were 1,165,379 million cubic feet, which include proved reserves from new fields estimated to be 3,872 million cubic feet.[5] Two new gas fields were discovered as a result of drilling 617 oil and gas wells in Arkansas during 1954. Of these total completions, 337 were productive of oil or gas and 280 were dry.

TABLE 2.—Coal production, 1945–49 (average) and 1950–54

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1945–49 (average)	1,596,009	$10,349,691	$6.48	1952	873,088	$6,839,113	$7.83
1950	1,169,068	8,882,876	7.60	1953	775,207	6,143,757	7.93
1951	1,106,705	8,686,410	7.85	1954	477,268	3,589,217	7.52

TABLE 3.—Marketed production of natural gas, 1945–49 (average) and 1950–54,[1] in millions cubic feet

Year	Quantity	Value	Mills value per thousand cubic feet	Year	Quantity	Value	Mills value per thousand cubic feet
1945–49 (average)	48,828	$1,681,000	34	1952	42,325	$1,735,000	41
1950	48,047	1,682,000	35	1953	41,510	2,200,000	53
1951	44,656	1,786,000	40	1954	33,471	1,841,000	55

[1] Comprises gas either sold or consumed by producers including losses in transmission, amounts added to storage, and increases in gas pipelines.

TABLE 4.—Gross withdrawals and disposition of natural gas, 1950–54, in million cubic feet

Year	Withdrawals [1]			Disposition		
	From gas wells	From oil wells	Total	Marketed production [2]	Repressuring	Vented and wasted [3]
1950	38,260	31,160	69,420	48,047	16,844	4,529
1951	37,060	30,050	67,110	44,656	18,911	3,543
1952	40,400	27,200	67,600	42,325	22,070	3,205
1953	38,100	27,000	65,100	41,510	20,003	3,587
1954	36,000	20,000	56,000	33,471	18,568	3,961

[1] Marketed production plus quantities used in repressuring, vented, and wasted.
[2] Comprises gas sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas in pipelines.
[3] Includes direct waste on producing properties and residue blown to air.

[5] American Gas Association and American Petroleum Institute, Proved Reserves of Crude Oil, Natural-Gas Liquids and Natural Gas: Vol. 9, Dec. 31, 1954, pp. 9, 10, 18.

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Natural-Gas Liquids.—Production of natural-gas liquids from 10 cycle plants in Arkansas in 1954 decreased 4 percent in quantity to 109 million gallons while the value decreased 14 percent to $5.8 million from 1953. Over the same years, production of natural gasoline and cycle products decreased 13 percent to 50.8 million gallons, and the value decreased 22 percent to $3.2 million. LP-gases increased 6 percent in quantity to 58.5 million gallons, and the value decreased 2 percent to $2.5 million. Proved recoverable reserves of natural-gas liquids in 1954 were estimated at 46.9 million barrels, which includes an estimated 45,000 barrels of reserves discovered in 1954, a decrease of 2.7 million barrels from the 1953 estimate.[6]

TABLE 5.—Natural-gas liquids produced, 1945–49 (average) and 1950–54

Year	Natural gasoline and cycle products		LP-gases		Total	
	Thousand gallons	Value	Thousand gallons	Value	Thousand gallons	Value
1945–49 (average)	55,932	$3,572,800	35,095	$1,291,200	91,027	$4,864,000
1950	58,590	3,926,000	39,396	1,197,000	97,986	5,123,000
1951	58,212	4,247,000	40,404	1,606,000	98,616	5,853,000
1952	61,782	4,580,000	49,098	2,079,000	110,880	6,659,000
1953	58,422	4,123,000	55,188	2,562,000	113,610	6,685,000
1954	50,778	3,234,000	58,506	2,521,000	109,284	5,755,000

TABLE 6.—Production and value of natural-gas liquids in 1954, by types of product in thousand gallons

Type of product	Thousand gallons	Value	Type of product	Thousand gallons	Value
Natural gasoline	48,132	$3,048,000	Other products	2,646	$186,000
LP-gases	58,506	2,521,000			
Finished gasoline and naphtha			Total	109,284	5,755,000

TABLE 7.—Natural-gasoline and cycling plants

Company	Location	Daily capacity, barrels					Process
		LP-gases			Natural gasoline and other products	Total	
		Propane	Butane	Other			
Arkansas-Louisiana Gas Co	Magnolia	476	667	[1] 405	1,262	2,810	Absorption.
Arkla Oil Co	Rodessa		150		400	550	Do.
Hiwan Oil & Gas Co	Magnolia			[2] 250	250	500	Do.
Magnolia Petroleum Co	Smackover			[2] 21	130	151	Do.
Lion Oil Co	El Dorado	179	179		475	833	Cycling.
McKamie Gas Cleaning Co	Lerch	430	273	[1] 251	750	1,704	Do.
J. R. Querbes Oil Co	El Dorado				136	136	Absorption.
Shell Oil Co	Magnolia	405	428		1,262	2,095	Do.
Sunray Oil Corp	Patmos	138	187	[3] 128	154	607	Do.
Total		1,628	1,884	1,055	4,819	9,386	

[1] Isobutane.
[2] LP-gas mixture.
[3] Isopentane.

[6] Work cited in footnote 5.

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Petroleum.—Petroleum, the leading mineral resource in the State, was produced from eight counties, with Union and Columbia the leading producers. Production in 1954 decreased 2 percent to 29 million barrels, while the value increased 3 percent to $79 million from 1953. The reduction in output complied with the allowable production set by the State regulatory body. In 1954 there were 4,410 producing wells. The average daily production of these wells was 18.6 barrels per well, compared with 20.0 barrels for the 4,190 wells in 1953. The average price per barrel of crude oil at the well was $2.73 in 1954, compared with $2.60 in 1953. Of the 141 exploratory wells drilled, 17 proved oil and 3 gas, and 121 were dry. The total estimated proved reserves of crude oil in 1954 were 351 million barrels, a decrease of 2 percent from 1953. New fields and extensions added 1 million barrels.[7] Arkansas refinery runs to stills were 23,944,388 barrels in 1954, a net increase of 764,952 barrels over 1953. Six refineries in the State had a total daily crude-oil capacity of 74,400 barrels. Lion Oil Co. expanded refining capacity at its El Dorado refinery from 22,000 barrels per day to 24,000. Facilities include fluid catalytic cracker, vapor-recovery unit, alkylation plant, deethanizer unit, and other supporting facilities. An Ultraformer went on stream at Pan-Am Southern Corp., El Dorado refinery. Ultraforming is a catalytic-reforming process used to upgrade low-octane

TABLE 8.—Production of crude petroleum, 1945–49 (average) and 1950–54, in thousand 42-gallon barrels

Year	Thousand barrels	Value		Year	Thousand barrels	Value	
		Total	Average per barrel			Total	Average per barrel
1945–49 (average)	29,721	$54,780,000	$1.84	1952	29,440	$72,420,000	$2.46
1950	31,108	76,530,000	2.46	1953	29,681	77,170,000	2.60
1951	29,798	73,900,000	2.48	1954	29,130	79,520,000	2.73

TABLE 9.—Production of crude petroleum, 1950–54, by fields

(Thousand barrels)

Field	1950	1951	1952	1953	1954 [1]
Atlanta	999	841	810	649	554
Buckner	798	719	722	645	529
Dorcheat-Macedonia	983	875	877	841	624
Fouke	894	929	1,053	1,429	1,210
Horsehead			29	194	706
Magnolia	4,547	4,407	4,223	4,029	3,289
McKamie	1,179	1,175	1,446	1,369	1,480
Midway	2,786	2,684	2,674	2,642	2,262
Schuler	2,854	2,626	2,377	2,318	2,599
Smackover	3,991	3,910	3,814	3,892	4,370
Stephens	1,774	1,476	1,308	1,223	1,077
Village	1,677	1,247	1,018	840	850
Wesson	3,452	3,647	3,510	3,296	2,699
Other fields [2]	5,174	5,262	5,579	6,314	6,881
Total	31,108	29,798	29,440	29,681	29,130

[1] Final figures.
[2] Includes oil consumed on leases and net change in stocks held on leases for entire State.

[7] Work cited in footnote 5, p. 3.

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naphthas to high-octane gasolines, for producing high-octane components for aviation gasoline and for producing high yields of aromatics for petro-chemicals.

TABLE 10.—Production of crude petroleum in 1954, by months

Month	Thousand barrels	Month	Thousand barrels
January	2,438	July	2,548
February	2,309	August	2,376
March	2,558	September	2,304
April	2,447	October	2,372
May	2,524	November	2,395
June	2,462	December	2,397
		Total: 1954	29,130
		1953	29,681

TABLE 11.—Indicated demand for crude petroleum in 1954, by months

(Thousand barrels)

Month	Indicated demand	Month	Indicated demand
January	2,491	July	2,285
February	2,210	August	2,610
March	2,648	September	2,339
April	2,118	October	2,514
May	2,790	November	2,385
June	2,394	December	2,316
		Total: 1954	29,100
		1953	29,897

TABLE 12.—Sales of petroleum products, 1950–54

(Thousand barrels)

Product	1950	1951	1952	1953	1954
Gasoline	9,147	10,119	10,672	11,025	[1] 11,530
Kerosine	1,741	1,777	1,736	1,390	1,394
Range oil	964	1,050	1,051	876	830
Distillate fuel oil	2,414	2,244	2,325	2,222	2,136
Residual fuel oil	2,273	2,051	1,497	1,006	415

[1] Consumption compiled by American Petroleum Institute.

Pipelines.—Arkansas-Louisiana Gas Co., Shreveport, La., was authorized by the Federal Power Commission to construct a 136-mile pipeline and a 10,500-horsepower compressor station to serve areas which include most of northern Louisiana, a substantial part of Arkansas, and a small area in east Texas. The new facilities will increase the total peak-day delivery capacity of the company system from 670 million to 816 million cubic feet of natural gas. The Oklahoma Mississippi River Products Co. built 341 miles of 10- and 12-inch pipeline from Duncan, Okla., to West Memphis, Ark. The Stephens Products Co. built 11 miles of 12-inch pipeline from the West Cecil field to the West Lavaca field.

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TABLE 13.—Oil- and gas-well drilling in 1954 [1]

County	Proved field wells			Exploratory wells			Total		
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry
Arkansas						3			3
Baxter						1			1
Bradley			1						1
Calhoun	5		2	1		2	6		4
Chicot						1			1
Clay						2			2
Cleburne						1			1
Columbia	24		7	1		12	25		16
Conway						1			1
Crawford						1			1
Desha						2			2
Franklin		2	4		2			4	4
Grant						1			1
Hempstead						6			6
Howard						1			1
Johnson						1			1
Lafayette	23		20	4		13	27		33
Logan						2			2
Lonoke						2			2
Madison						1			1
Marion						1			1
Miller	14		12			14	14		26
Monroe						1			1
Nevada	43		34	4		10	47		44
Ouachita	27		20	1		9	28		29
Polk						2			2
Pope					1			1	
Scott						2			2
Sebastian						1			1
Sevier						1			1
Union	177	2	57	6		21	183	2	78
Washington			2						2
White						5			5
Woodruff						1			1
Total	313	4	159	17	3	121	330	7	280

[1] National Oil Scouts and Landmen's Association, Oil- and Gas-Field Development in United States: Vol. 25, 1955.

TABLE 14.—Capacity of petroleum refineries and cracking plants in 1954

(Barrels per day)

Company	Location	Crude-oil capacity operating	Type of plant	Cracked-gasoline capacity operating
Berry Asphalt Co	Stephens	1,800	Skimming and asphalt	
Do	Waterloo	1,500	Skimming, lube, and asphalt	
Henry H. Cross Co	Smackover	6,000	do	
Lion Oil Co	El Dorado	27,500	Complete	5,500
Macmillan Petroleum Corp	Norphlet	4,000	Skimming and lube	
Pan-Am Southern Corp	El Dorado	33,600	Skimming and cracking	15,600
Total		74,400	Total	21,100

METALS

Bauxite.—Arkansas remained the leading domestic producer of bauxite, with 98 percent of the total production. Mine production in 1954, in dried equivalent, increased 27 percent to 1.9 million long tons and the value increased 23 percent to $16 million. The aluminum industry's "second-round" expansion program was virtually completed in 1954. Included was the Reynolds Metals Co. new $34-

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million Robert P. Patterson aluminum-reduction plant near Arkadelphia, which started operation in February 1954. The plant has an annual rated capacity of 55,000 tons of virgin aluminum. Potrooms are 1,827 feet long. Some 400 workers will be employed when the plant is in full operation. Although the major quantity of crude bauxite was consumed by the aluminum industry, the chemical industries have decreased their consumption of bauxite for aluminum chemicals. Calcined bauxite was produced for refractories and abrasives. Bauxite was activated for the petroleum industry for desulfurizing, deodorizing, and decoloring oils. One of the outstanding developments in the use of aluminum during 1954 was in the building field, which has led all classes of civilian application since World War II.

TABLE 15.—Mine production of bauxite and shipments from mines and processing plants to consumer, 1945–49 (average) and 1950–54, in long tons

	Mine production			Shipments from mines and processing plants to consumers		
	Crude	Dried-bauxite equivalent	Value	As shipped	Dried-bauxite equivalent	Value
1945–49 (average)	1,331,330	1,120,845	$6,618,437	1,276,032	1,134,724	$7,535,429
1950	1,552,047	1,307,335	7,531,535	1,416,724	1,301,374	9,277,076
1951	2,153,786	1,815,274	12,259,742	1,583,320	1,493,557	11,994,882
1952	1,903,101	1,603,833	10,235,254	2,067,241	1,849,287	14,084,274
1953	1,802,797	1,529,976	12,975,992	1,889,206	1,689,207	15,042,236
1954	2,296,528	1,949,368	15,993,887	1,875,822	1,597,234	13,101,998

Columbium.—The Federal Bureau of Mines continued its research—seeking practicable methods for exploiting the large potential columbium resources in Arkansas. The Bureau of Mines, in cooperation with Emergency Procurement Service, GSA, conducted laboratory and pilot-plant research on recovering columbium from titanium minerals found in central Arkansas and from tailings from alumina plants using certain Arkansas bauxite. The annual alumina-plant feed, operating full capacity, would contain about 3.6 million pounds of columbium.

TABLE 16.—Manganese ores shipped from mines, 1945–49 (average) and 1950–54, in short tons

Year	Manganese ore [1]		Year	Manganese ore [1]	
	Gross weight	Mn content		Gross weight	Mn content
1949–49 (average)	2,334	1,011	1952	2,246	1,007
1950	1,224	473	1953	6,123	2,812
1951	3,718	1,442	1954	13,728	5,407

[1] Containing 35 percent or more manganese (natural).

Manganese.—Manganese was purchased by General Services Administration (GSA) for the Government stockpile. The Government purchase programs for low-grade manganese have stimulated the research in mining methods and beneficiation of low-grade manganese

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ore. The major portion of Arkansas manganese production originated in Independence County; small quantities were mined in Izard and Sharp Counties.

NONMETALS

Abrasive Stone.—Production of abrasive stone in Arkansas decreased during the year. All of the production was from Garland County.

Barite.—Arkansas remained the leading producer of barite in the United States. The tonnage dropped 3 percent to 370,600 short tons, and value decreased 12 percent to $3.5 million from 1953. The Arkansas barite production is concentrated and processed in Hot Spring County. Increasing exploration and development of petroleum assures an increasing demand for barite in drilling muds. Magnet Cove Barium Corp. has installed two new crushing units in its barite plant at Malvern.

TABLE 17.—Primary barite sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1945–49 (average)	330,163	$2,395,308	$7.25	1952	428,522	$3,963,828	$9.25
1950	343,168	3,088,512	9.00	1953	380,763	3,945,583	10.36
1951	407,085	3,765,536	9.25	1954	370,621	3,488,483	9.41

Cement.—Shipments of cement from the Ideal Cement Co. plant near Okay, Howard County, continued to increase during 1954.

Clays.—The production of clays in Arkansas was 617,450 short tons valued at $2.6 million, an increase of 17 percent in quantity and 47 percent in value from 1953. Fire clay production was 59 percent of the total Arkansas clay production. Refractories were produced at Malvern and Perla in Hot Spring County. Clay for heavy clay products, such as brick, and tile, was produced in 11 other counties.

TABLE 18.—Clays sold or used by producers, 1945–49 (average) and 1950–54, by kinds

Year	Miscellaneous clay		Fire clay		Total clay	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	188,951	$168,955	209,168	$671,849	398,119	$840,804
1950	219,117	217,127	256,042	789,876	475,159	1,007,003
1951	171,518	184,532	319,941	1,022,326	491,459	1,206,858
1952	166,465	176,392	386,111	1,337,542	552,576	1,513,934
1953	197,874	209,549	331,252	1,524,865	529,126	1,734,414
1954	[1] 254,490	[1] 555,891	362,960	2,000,476	617,450	2,556,367

[1] Kaolin and clay used for cement combined with miscellaneous clay to avoid disclosure.

Gypsum.—Gypsum was produced in Arkansas by the Arkansas Gypsum Co. at its mine near Murfreesboro, Pike County. Production continued to increase in 1954.

Lime.—The two producers of lime in Independence and Saline Counties continued to increase their production during 1954.

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Perlite.—No crude perlite ore is produced in Arkansas; however, perlite was expanded in Arkansas for building aggregate.

Sand and Gravel.—Increased construction and road building in Arkansas caused sand and gravel production to increase 35 percent to 6.6 million short tons valued at $6.6 million, an increase of 33 percent from 1953. Miller, Hot Spring, and Crawford Counties were the largest producers.

TABLE 19.—Sand and gravel sold or used by producer, 1953–54, by class of operations and uses

	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Building	751,745	$405,955	$0.54	632,011	$635,880	$1.01
Paving	308,649	226,618	.73	644,048	573,568	.89
Grinding and polishing						
Gravel:						
Building	64,404	67,694	1.05	389,031	428,712	1.10
Paving	707,351	823,496	1.16	1,978,594	2,251,567	1.14
Railroad ballast	277,324	220,587	.80	132,862	115,570	.87
Other	(1)	(1)	(1)	23,468	31,513	1.34
Undistributed [2]	268,473	554,425	2.07	311,463	654,844	2.10
Total commercial	2,377,946	2,298,775	.97	4,111,477	4,691,654	1.14
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Paving	197,500	144,325	.73			
Gravel:						
Paving	2,328,389	2,512,283	1.08	2,500,383	1,875,152	.75
Total Government-and-contractor	2,525,889	2,656,608	1.05	2,500,383	1,875,152	.75
Grand total	4,903,835	4,955,383	1.01	6,611,860	6,566,806	.99

[1] Figure withheld to avoid disclosure of individual company operations.
[2] Includes glass, molding, engine, railroad ballast, and other sand and gravel; Bureau of Mines not at liberty to publish separately.

Slate.—Slate production at Caddo Gap in Montgomery County increased during the year.

Soapstone.—The production and value of soapstone increased during 1954, all from Saline County.

Stone.—Limestone used to manufacture cement and lime has been included in the 1954 total stone. In previous years this was not included, hence the large increase in quantity and value. Big Rock Stone & Material Co. new crushed-syenite operation, south of Little Rock, Ark., can produce 2.5 million tons a year. The operations include a 140-foot-diameter thickener, finish-mill building, and syenite quarry. The operation features jet piercing.

Sulfur, Recovered Elemental.—Byproducts sulfur recovered from cycle plants increased 11 percent in value, while the quantity decreased 4 percent from 1953. Columbia and Lafayette Counties produced all of the recovered elemental sulfur for Arkansas.

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TABLE 20.—Stone sold and used by producers, 1950–54, by kinds

Year	Marble		Limestone		Sandstone		Miscellaneous stone		Total stone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1950	1,350	$17,250	2,470,490	$5,848,341	180,370	$235,822	1,300,510	$1,317,697	3,952,720	$7,419,110
1951	1,525	95,200	826,896	1,298,154	-------	-------	1,707,325	1,823,072	2,535,746	3,216,426
1952	321	14,588	778,380	910,459	28,271	115,017	2,160,507	2,306,137	[1] 2,967,479	[1] 3,346,201
1953	349	9,500	1,161,752	1,984,316	264,907	432,830	2,118,342	2,643,104	3,545,350	5,069,750
1954	479	24,035	(2)	(2)	(2)	(2)	(2)	(2)	4,604,067	5,929,638

[1] Incomplete figure; excludes dimension miscellaneous stone.
[2] Figure withheld to avoid disclosure of individual company operations.

REVIEW BY COUNTIES

Mineral production was reported from 42 of the 75 counties in Arkansas. Independence, Izard, Nevada, Pulaski, Saline, and Sharp Counties produced metals. Nonmetals were produced mainly in the western half of the State. Petroleum was produced in seven counties, with Union and Columbia the largest producers. Natural gas was produced in 12 counties, mainly in Lafayette, Union, Columbia, and Franklin. Natural-gas liquids were produced from nine plants in the southern counties—Columbia, Lafayette, Union, Hempstead, and Miller. Coal was produced in five counties.

Calhoun.—Calhoun County ranked fourth in the production of sand and gravel. St. Francis Materials Corp. and Sam D. Crawford operated sand and gravel quarries shipping paving and railroad ballast. Ouachita Aggregate Co. produced gravel for paving and structural purposes. Petroleum was also produced.

Clark.—Miscellaneous clay for brick manufacture was mined by the Hope Brick Works at Arkadelphia. The Arkadelphia Sand & Gravel Co. produced structural and paving sand and gravel.

Columbia.—Columbia County ranked first in the production of natural-gas liquids, second in crude oil, and third in natural gas. Arkansas-Louisiana Gas Co., Hiwan Oil & Gas Co., and Shell Oil Co. operated natural-gasoline and cycling plants in the county. Lion Oil Co. and Olin Mathieson Agricultural Division recovered elemental byproduct sulfur.

Craighead.—Hall-Wheeler Brick Co. mined red clay for its brick plant near Jonesboro. Paving gravel was produced by the Cotton Belt Gravel Co., and railroad-ballast gravel was quarried by R. D. Davenport.

Franklin.—Franklin County ranked fourth in the production of gas. Coal was produced, chiefly for steam generation, by the Arnold Coal Co. near Charleston and Rickard Coal Co. near Denning.

Garland.—The entire State production of oilstone and whetstone was from Garland County. Producers included Lewis Whetstone Co., Archer J. Smith, and J. A. Thomas.

Hempstead.—Hempstead County ranked fourth in the production of natural-gas liquids in Arkansas. Sunray Oil Corp. operated its natural-gasoline and cycling plant near Patmos. Miscellaneous clay for brick was produced by Hope Brick Works.

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TABLE 21.—Value of mineral production in Arkansas, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value
Ashley	(2)		
Baxter	(2)		
Benton	(2)	(2)	Stone.
Calhoun	$493,339	$570,645	Sand and gravel, petroleum.
Chicot	(2)		
Clark	(2)	(2)	Sand and gravel, clay.
Clay	(2)	(2)	Sand and gravel.
Columbia	27,262,221	24,124,608	Petroleum, natural-gas liquids, natural gas, sulfur.
Conway	(2)		
Craighead	98,325	60,847	Sand and gravel, clays.
Crawford	(2)	(2)	Sand and gravel, natural gas.
Cross	(2)	(2)	Sand and gravel.
Dallas	(2)		
Drew	(2)	(2)	Sand and gravel.
Faulkner	(2)	(2)	Stone.
Franklin	323,660	378,641	Natural gas, coal.
Garland	(2)	(2)	Oilstones, whetstones.
Greene	(2)	(2)	Sand and gravel.
Hempstead	504,592	412,057	Natural-gas liquids, clays.
Hot Spring	5,465,121	6,225,063	Barite, clays, sand and gravel, stone.
Howard	(2)	(2)	Cement, stone, clay.
Independence	1,447,186	2,034,056	Manganese, lime, stone, sand and gravel.
Izard	968,973	1,275,586	Stone, sand and gravel, manganese.
Jackson	(2)	(2)	Sand and gravel.
Jefferson	(2)	(2)	Do.
Johnson	2,894,904	2,153,895	Coal, stone, clays, natural gas.
Lafayette	15,399,307	15,919,611	Petroleum, natural-gas liquids, sulfur, natural gas, sand and gravel.
Lawrence	(2)	(2)	Stone, sand and gravel.
Little River	(2)	(2)	Sand and gravel.
Logan	784,222	513,944	Coal, stone.
Miller	4,667,977	5,445,506	Petroleum, sand and gravel, natural-gas liquids, clays, natural gas.
Mississippi	(2)	(2)	Sand and gravel.
Montgomery	315,858	379,076	Slate.
Nevada	1,414,283	2,547,358	Petroleum, iron ore, natural gas.
Ouachita	17,093,631	10,303,658	Petroleum, sand and gravel, natural gas, clays.
Pike	(2)	(2)	Gypsum.
Polk	(2)	(2)	Clay.
Pope	230,311	66,714	Sand and gravel, natural gas, coal.
Pulaski	4,309,149	4,870,308	Stone, bauxite, sand and gravel, clays.
St. Francis	(2)	(2)	Sand and gravel.
Saline	12,158,253	14,944,785	Bauxite, clays, lime, talc.
Sebastian	2,679,034	1,243,250	Coal, clays, natural gas.
Sharp	(2)	(2)	Manganese.
Union	20,514,756	30,384,096	Petroleum, natural-gas liquids, natural gas, clays.
Washington	(2)	(2)	Natural gas.
White	(2)	(2)	Stone.
Yell	(2)	(2)	Do.
Other counties	3,782,236	1,899,438	Sand and gravel, stone.
Undistributed	4,282,662	6,629,391	
Total	127,090,000	[3] 131,745,000	

[1] The following counties are not listed, because no production was reported: Arkansas, Boone, Bradley Carroll, Cleburne, Cleveland, Crittenden, Desha, Fulton, Grant, Lee, Lincoln, Lonoke, Madison, Marion, Monroe, Newton, Phillips, Poinsett, Prairie, Randolph, Scott, Searcy, Sevier, Stone, Van Buren and Woodruff.
[2] Included with "Undistributed."
[3] The total has been adjusted to eliminate duplication in the value of clays and stone.

Hot Spring.—All of the barite produced in Arkansas was from Hot Spring County. Baroid Sales Division of National Lead Co. and Magnet Cove Barium Corp. were the only producers. Hot Spring County ranked first in the production of clays, second in sand and gravel, and fourth in stone in the State. Refractories and heavy clay products were produced by Acme Brick Co. and Malvern Brick & Tile Co. at Perla and Malvern, respectively. Coogan Gravel Co. quarried gravel for paving and railroad ballast, and the Malvern Gravel Co. produced structural and paving sand and gravel. Sandstone was crushed in Hot Spring County.

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Independence.—Independence County, with 17 producers, ranked first in the production of manganese in the State. Production of manganese was double that in 1953. Lime for building, chemical, and other industrial uses was produced and limestone for flux and agricultural purposes was crushed by Batesville White Lime Co. near Batesville. A small amount of dimension marble was quarried by P. H. Scheid Cut Stone Co. Building sand and gravel was produced by the Galloway Sand & Gravel Co.

Izard.—Izard County ranked third in the production of sand and gravel and stone. Glass, molding, and oil-well fracturing sands were produced by the Silica Products Co., Inc., at its pit near Guion. Crushed limestone for the aluminum industry was produced by Aluminum Co. of America near Love Hollow and Arkansas Limestone Co. near Myersville. Manganese ore also was produced.

Jackson.—Sand and gravel for paving and building was quarried by Allbright Bros. Contractors, Inc., and Mobley Construction Co., Inc., from deposits near Newport.

Johnson.—Johnson County ranked first in the production of coal. Coal from the eastern part of the county was used for domestic consumption, while that from the western part was sold to the steel industries. There were seven underground and eight open-pit mines. The largest underground producers were Clarksville Coal Co. and Sunshine Coal Co., both hear Clarksville. The more important open-pit producers were Utah Construction Co. near Ozark, Arkansas Coal Co. near Hartman, and Morrow Coal Co. near Clarksville. Dimension sandstone was produced by the Texas Ledge Stone Co. near Lamar. Miscellaneous clay for heavy clay products was mined by the Eureaka Brick & Tile Co. Natural gas was also produced.

Lafayette.—Lafayette County ranked first in the production of natural gas and recovered elemental sulfur, second in natural-gas liquids, third in crude oil, and fifth in sand and gravel. McKamie Gas Cleaning Co. operated its natural-gasoline and cycling plant near Lerch. Meriwether Gravel Co., Inc., produced building gravel and paving sand and gravel.

Logan.—Coal was produced for domestic purposes in Logan County by 11 producers. Larger coal producers were Dixie Fuel Co., Hixon Fuel Co., and Jewel Mining Co. all near Paris. Stone was also produced.

Miller.—Miller County ranked first in sand and gravel production. Gifford Hill & Co. produced filter sand, structural and paving sand, and paving gravel for building, paving, and railroad ballast. Petroleum, natural gas, and natural-gas liquids were produced in the county. W. S. Dickey Clay Manufacturing Co. mined shale for heavy clay products. Arkla Oil Co. operated its natural-gasoline and cycling plant at Rodessa.

Nevada.—Petroleum and natural gas were produced in Nevada County. Barry Asphalt Co. operated its skimming and asphalt refinery at Waterloo. Hematite was produced by the Scott Plumbing & Home Maintenance Co. and brown iron ore by Robertson & Rosston. These ores were used to produce pig iron and steel.

Ouachita.—Ouachita County ranked fourth in the production of crude oil. Barry Asphalt Co. operated its petroleum skimming, lube, and asphalt refinery at Stephens. Natural gas was produced in the

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county. Standard Gravel Co. quarried paving sand and gravel near Camden. Miscellaneous clay for heavy clay products was mined by Hope Brick Works.

Polk.—W. S. Dickey Clay Manufacturing Co. mined shale for manufacturing heavy clay products.

Pope.—Structural and paving sand and gravel were quarried by the Mobley Construction Co., Inc., near Dardanelle. Natural gas was produced. Lee Coal Co. was the only coal producer in the county.

Pulaski.—Pulaski County ranked first in the production of stone and sixth in sand and gravel. Miscellaneous stone was produced in the expanded facilities of the Big Rock Stone & Material Co. near Little Rock; the company also produced structural and paving sands. Limestone for concrete and road metal was crushed by Frank Trager. Bauxite was produced by American Cyanamid Co. and Dulin Bauxite Co. Dried, calcined, and activated bauxites were also produced in Pulaski County. Roofing granules were produced by the Minnesota Mining & Manufacturing Co. Perlite was expanded at the Little Rock plant of Tennessee Products & Chemical Corp. of Nashville, Tenn. Vermiculite was exfoliated by the Zonolite Co.

Saline.—Saline County ranked first in the State and Nation in the production of bauxite. Aluminum Co. of America, American Cyanamid Co., Dulin Bauxite Co., Norton Co., Dickinson-McGeorge, Inc., and Reynolds Mining Corp. mined crude bauxite in 1954. Lime was produced by Aluminum Co. of America and Reynolds Metals Co. for chemical and industrial purposes. Clay was mined by the A. P. Green Fire Brick Co. and Arkansas Talc Co., Inc., near Bryant. The Milwhite Co. near Benton produced soapstone for asphalt filler, insecticides, roofing, and rubber products.

Sebastian.—Sebastian County ranked second in the production of coal, with 11 underground and 9 open-pit operations. Large producers were Peerless Coal Co., east of Hackett; Quality Excelsior Coal Co., west of Greenwood; F. S. Neely Co., near Huntington; and Boyd Excelsior Fuel Co., near Greenwood. Shale was mined near Fort Smith by Acme Brick Co. for heavy clay products. Natural gas was reported.

Union.—Union County ranked first in the production of crude oil, second in natural gas, and third in natural-gas liquids. Magnolia Petroleum Co., Lion Oil Co., and J. R. Querbes Oil Co. operated natural-gasoline and cycling plants in the county. Four petroleum refineries and cracking plants were operated in the county by Henry H. Cross Co., near Smackover; Lion Oil Co., near El Dorado; Macmillan Petroleum Corp., near Norphlet; and Pan-Am Southern Corp., near El Dorado. The El Dorado Brick Works produced common and face brick from surface clay mined near El Dorado.

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The Mineral Industry of California

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the California Department or Natural Resources, Division of Mines.

By R. E. Wallace,[1] J. D. McLenegan,[1] and E. J. Matson[1]

THE VALUE of California mineral production in 1954 reached an alltime high of $1,430 million, an increase of $36 million or 3 percent over the previous high in 1953. Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences of coverage. Decreasing production of most metallic minerals and petroleum and natural gas was countered by nonmetallic mineral increases in quantity and value. Owing to higher values of natural-gas liquids in 1954, output of mineral fuels, which comprised 79 percent of the State total, was $1,123 million, a $2 million increase compared with 1953.

Metals and metallic ores produced in 1954 had a value of $40.2 million, or slightly less than 3 percent of the State total. This was an increase of $2.2 million, or 3 percent, more than $38 million, the 1953 value, owing primarily to increases in tungsten and mercury production. Tungsten output credited to California mines increased 48 percent in quantity and value compared with 1953; and the mercury yield, stimulated by record high market prices and the guaranteed floor price offered by the Government Purchase Program, increased 21 percent in quantity and 66 percent in value over 1953. Chromite and manganese (also supported by Government purchases), gold, and platinum (a byproduct of placer-gold mining) all showed production increases. Declines in mine output were reported for silver, lead, zinc, iron ore, and rare-earth metal concentrate. Shipments of molybdenum concentrate recovered from tungsten ores were lower in 1954 than in 1953. An undetermined quantity of antimony was recovered from California lead and gold ores shipped to lead smelters, and recoverable selenium and cadmium were components of some lead-zinc ores mined in the State. Consumption of scrap metals at California plants decreased over 1953 because of the generally lower level of business activity in 1954.

[1] Commodity-industry analyst, Region II, San Francisco, Calif.

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TABLE 1.—Mineral production in California, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Boron minerals	715,228	$17,668,000	790,449	$26,714,440
Cement, 376-pound barrels	32,002,317	90,872,741	32,761,990	98,251,245
Chromite, gross weight	26,512	2,078,461	30,661	2,285,250
Clays	2,429,888	4,952,723	2,722,850	4,477,174
Copper (recoverable content of ores, etc.)	382	219,268	362	213,580
Gold (recoverable content of ores, etc.), troy ounces	234,591	8,210,685	237,886	8,326,010
Gypsum	1,199,489	2,855,983	1,161,502	2,803,862
Iron ore (usable), long tons, gross weight	1,697,652	[2]	1,270,292	[2]
Lead (recoverable content of ores, etc.)	8,664	2,269,968	2,671	731,854
Lime (open-market)	301,422	4,653,303	212,381	3,387,981
Magnesium compounds from sea water and bitterns (partly estimated) MgO equivalent	55,886	3,483,483	40,969	2,715,689
Manganese ore (35 percent or more Mn), gross weight	5,413	[2]	831	45,091
Manganiferous ore (5 to 35 percent Mn), do	534	10,355	[2]	[2]
Marl, calcareous	6,028	21,102	5,464	21,965
Mercury, 76-pound flasks	9,290	1,793,249	11,262	2,977,560
Natural gas (marketed production), million cubic feet	531,346	104,675,000	507,289	104,502,000
Natural-gas liquids:				
Natural gasoline and cycle products, thousand gallons	910,350	85,691,000	923,160	89,293,000
LP-gases, do	397,572	21,961,000	396,186	22,262,000
Peat	9,196	73,897	8,090	85,358
Perlite	15,282	112,790	14,811	103,148
Petroleum (crude), thousand 42-gallon barrels	365,085	909,060,000	[3] 355,865	[3] 907,460,000
Pumice and pumicite	433,105	647,910	566,664	651,638
Salt (common)	1,123,365	6,263,059	1,185,844	6,126,194
Sand and gravel	58,429,528	53,224,203	70,524,612	68,138,578
Silver (recoverable content of ores, etc.), troy ounces	1,036,372	937,969	309,575	280,181
Stone (except limestone for cement and lime, 1953)	[4] 14,497,348	[4] 18,472,652	23,303,756	37,541,114
Strontium minerals	50	1,000	12	300
Sulfur ore, long tons	152,203	[2]	185,085	[2]
Talc, pyrophyllite, and soapstone	126,442	1,132,700	133,474	1,211,201
Tungsten concentrate, 60-percent WO_3 basis	2,382	8,939,146	3,512	13,209,371
Zinc (recoverable content of ores, etc.)	5,358	1,232,340	1,415	305,640
Undistributed: Asbestos, barite, bromine, calcium-magnesium chloride, carbon dioxide, coal (lignite, 1954), diatomite, feldspar, garnet gem stones, iodine, lithium minerals, magnesite, mica (1954), molybdenum, platinum-group metals (crude), potassium salts, pyrites, quartz (1953), ground sand and sandstone (1953), slate, sodium carbonate and sulfate, stone (dimension limestone and crushed marble, 1953), recovered elemental sulfur, titanium iron concentrate (non-titanium use), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2). Excludes values of clays used for cement (1953)	----------	[4] 42,473,296	----------	43,652,525
Total California	----------	[4] 1,393,987,000	----------	[5] 1,429,627,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers). Excludes uranium and monazite.
[2] Value included with "Undistributed."
[3] Final figure. Supersedes preliminary figure given in commodity chapter.
[4] Revised figure.
[5] Total adjusted to eliminate duplication in the value of clays and stone.

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Los Angeles County, with 23 percent of the State mineral value in 1954, ranked first among the counties reporting production and was followed in order by Kern, Ventura, Orange, and Fresno Counties.

Nonmetallic minerals as a group had a production value of $267 million, or 19 percent of the State total in 1954. This was an increase of $32 million or 14 percent over $235 million, the value in 1953. Cement, sand and gravel, and stone were prominent in the advance due to increased building, highway construction, and water-resources developments in the State. In sand and gravel some of the increase can be attributed to better coverage of the industry through the Bureau of the Census canvass. Salines recovered from mined material and dry-lake brines in the arid regions of southern California, and from sea water and saltworks bitterns in the coastal areas and brines of the Los Angeles Basin petroleum fields represented about 21 percent of the State's nonmetallic mineral value. This group of minerals increased 18 percent in value over 1953. Of the principal ceramic materials, clay output increased sustantially in quantity and value, and talc, pyrophyllite, and soapstone production was slightly higher than in the previous year. Lime produced from California limestone and dolomite had decreased consumption in the iron and steel industries owing to the 90-day steel strike. The value of the State yield of sulfur in 1954 was almost twice that in 1953 due to the full-time operations of the copper-leaching operations at Yerington, Nev., which used California sulfur as raw material for sulfuric acid.

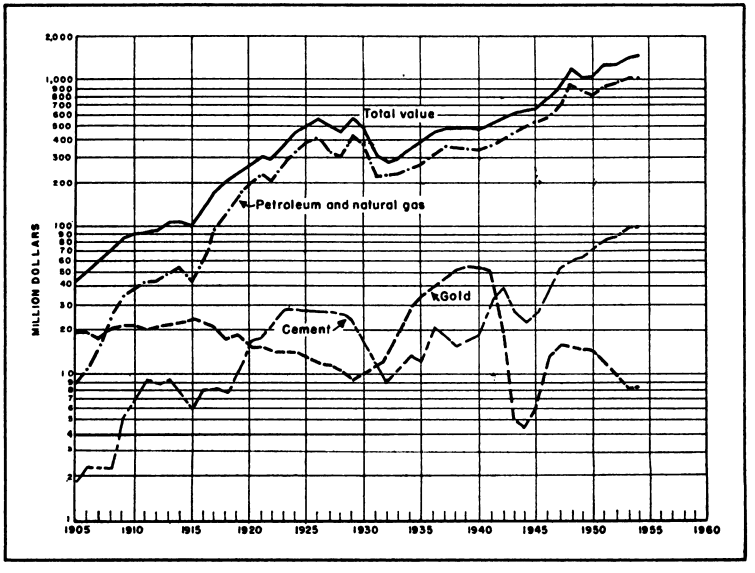

FIGURE 1.—Value of gold, petroleum and natural gas, cement, and total value of mineral production in California, 1905–54.

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TABLE 2.—Average United States prices of selected mineral commodities produced in California, 1945–49 (average) and 1950–54 [1]

Commodity	1945–49 (average)	1950	1951	1952	1953	1954
Cement (average net mill realization) dollars per barrel	1.95	2.35	2.54	2.54	2.67	2.76
Copper [2] cents per pound	17.7	20.8	24.2	24.2	28.7	29.5
Fluorspar (average all types) dollars per ton	33.05	35.22	41.41	46.35	49.48	50.21
Gold [3] dollars per troy ounce	35.00	35.00	35.00	35.00	35.00	35.00
Iron ore (average value at mine) dollars per long ton	3.56	4.99	5.46	6.09	6.76	6.99
Lead [2] cents per pound	13.8	13.5	17.3	16.1	13.1	13.7
Mercury [4] dollars per 76-pound flask	94.56	81.26	210.13	199.10	193.03	264.39
Molybdenum concentrate, 90 percent MoS_2 concentrate cents per pound MoS_2	46.8	54.5	60.0	60.0	60.0	60.1
Silver [5] cents per troy ounce	86.6	90.5+	90.5+	90.5+	90.5+	90.5+
Tungsten concentrate dollars per short ton unit WO_3	23.89	28.25	61.02	63.44	[6] 62.46	[6] 62.61
Zinc [2] cents per pound	12.02	14.2	18.2	16.6	11.5	10.8

[1] Prices are discussed in detail in the commodity chapters of volume I, Minerals Yearbook.
[2] Yearly average weighted price of all grades of primary metal sold by producers.
Price in 1946–47 includes bonus payments by Office of Metals Reserve for overquota production.
[3] Price under authority of Gold Reserve Act of Jan. 31, 1934.
[4] Average quoted price at New York.
[5] Treasury buying price for newly mined silver, 1943 to June 30, 1946—$0.71111111; July 1, 1946 to Dec.31, 1947—$0.905; 1948–54—$0.9050505.
[6] Based on average of GSA purchases.

CONSUMPTION AND MARKETS

California ranked second among the Nation's mineral producers in 1954 and was one of the chief mineral consumers. Continued increase in the State population, accelerated construction, and expansion of industries during the decade 1944–54 has challenged mineral producers' ability to supply the variety of mineral commodities required.

The diversity of mineral products and industry in the State has resulted in a wide variety of marketing practices. Some mineral producers have dealt directly with the Government, such as gold producers who sold to the mint, or chromite producers who sold to General Services Administration. Others converted their raw mineral into a finished product—as for example the contractor who mines and washes the sand and gravel with which he builds concrete structures. The petroleum companies are an example of an integrated industry, consisting of prospectors, developers, producers, transporters, refiners, and finally retailers.

General Services Administration Purchase Depots and Stockpiles.—GSA did not maintain purchase depots in California but accepted tungsten concentrate in specified minimum quantities at designated milling points in the State, and carlots of manganese ores and concentrate destined to high-grade stockpiles were received at railheads. A large percentage of the California manganese ore and concentrate yield was transported to the Wenden, Ariz., low-grade stockpile by the producers, and virtually all the State chromite production was shipped to the Grants Pass, Oreg., Government Purchase Depot.

Custom Mills, Commercial Grinding Plants, and Smelters.—The leading metallurgical and grinding plants that received custom ores, concentrates, and nonmetallic minerals for processing in 1954 are listed in table 3. The largest metallurgical custom in California—the Selby lead plant and refinery of the American Smelting & Refining Co. at Selby, Contra Costa County—continued to be the State's only smelter treating primary nonferrous material.

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TABLE 3.—Principal custom mills, commercial grinding plants, and primary smelters in 1954

Name	County	Nearest city or town	Minerals processed	Remarks
Industrial Minerals & Chemical Co	Alameda	Berkeley	Nonmetallic minerals	Grinding by contract or minerals purchased.
Yuba Milling Co	do	Emeryville	do	Do.
American Smelting & Refining Co	Contra Costa	Selby	Gold, silver and lead ores and concentrates.	Gold and silvery refinery and slag-fuming plant operated in conjunction with lead smelter.
Twining Laboratories	Fresno	Fresno	Tungsten ore and nonmetallic minerals	Tungsten ore concentrated and nonmetallic minerals ground.
Ajax Tungsten Corp. Mill	Inyo	Bishop	Tungsten ore and concentrates	50-ton-a-day gravity-flotation concentrator.
El Diablo Mining Co	do	do	do	50-ton-a-day gravity concentrator.
United States Vanadium Co	do	Pine Creek	do	1,000-ton-a-day flotation–chemical plant.
Burton Bros	Kern	Rosamond	Gold-silver ores	300-ton-a-day cyanide plant.
Butte Lode Mining Co	do	Randsburg	Tungsten ore	36-ton-a-day gravity concentrator.
Macco Corp (Champco)	do	Rosamond	Nonmetallic minerals	Commercial fine grinding.
American Minerals Co	Los Angeles	Los Angeles	Clay and other nonmetallic minerals	Commercial grinding.
Hill Bros. Chemical Co	do	do	Asbestos, soft nonmetallic minerals	Custom mills, small lots of nonmetallic minerals.
Kennedy Minerals Co	do	do	Talc, clay, and other nonmetallic minerals.	Commercial grinding.
Los Angeles Chemical Co	do	do	Sulfur, pyrophyllite, mineral colors, miscellaneous nonmetallic minerals.	Grinding by contract or minerals purchased.
Southern California Minerals Co	do	do	Nonmetallic minerals	Contract grinding.
Sun Valley Tungsten Co	do	Sun Valley	Tungsten ore and concentrate	50-ton-a-day gravity concentrator.
Western Talc Co	do	Los Angeles	Nonmetallic minerals	Contract grinding.
Walter Thomas (Piute Mining & Milling Co.).	Mono	Bishop	Tungsten ore	50-ton-a-day gravity concentrator.
Empire Star Mines Co., Ltd	Nevada	Grass Valley	Gold-silver ore	500-ton-a-day amalgamation-cyanidation mill.
Commercial Minerals Co	San Francisco	San Francisco	Nonmetallic minerals	Grinding by contract or minerals purchased.
Palo Alto Mining Co	Santa Clara	Coyote	Chromite	100-ton-a-day gravity concentrator.
Tulare County Tungsten Mines	Tulare	Exeter or Lindsay	Tungsten ore and concentrates	Do.

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Mineral Brokers and Bullion Buyers.—Transaction in small lots of tungsten concentrate not accepted by GSA was the principal activity by mineral brokers. These purchases were accumulated for resale. Brokers also handled some small tonnages of chromite and iron ore for distribution within the State and larger tonnages of Utah and Nevada iron ore destined for export from California ports. Purchases of gold bullion by licensed buyers were seasonal and minor.

FLOW OF MINERALS

Moving California minerals is usually a complex integration of the available modes of transport. Basically, railroads handled a large percentage of the materials requiring long hauls, and motortrucks were used predominantly in the shorter trips. However, combination truck-railroad movement of minerals to their destination was common practice. There were exceptions to the general rule—as, for example, the long truck haulage of tungsten ore and concentrate to custom mills and chromite and manganese ores to depots outside the State. Transportation of minerals by water, formerly common practice in intrastate movements, was at a minimum. The following tabulation shows the modes of transporting a selected group of construction materials shipped in 1954.

TABLE 4.—Sand and gravel, crushed stone, and portland cement sold or used in 1954, by method of transportation

Material	Tonnage transported, by method				
	Railroad	Motor-truck	Waterway	Not stated [1]	Total
Sand and gravel (commercial)	4,471,819	42,905,188	8,013	3,405,903	50,790,923
Crushed stone (commercial)	1,328,912	9,272,863	1,218,320	872,908	12,693,003
Portland cement	1,546,079	4,487,067	126,108	----------	6,159,254
Total	7,346,810	56,665,118	1,352,441	4,278,811	69,643,180

[1] Includes interplant transfers to batching units, etc.

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Domestic Interstate Shipments.—California capacity to fulfill the local demand for raw minerals has been lessened considerably by the rapid rise in requirements occasioned by the State industrial expansion. Barite, coal (both for fuel and coke), elemental sulfur, special clays, fluorspar, silica, sand, gypsum, limestone, phosphate rock, crude perlite, asbestos, vermiculite, natural gas, and some petroleum were all noteworthy among the minerals and fuels shipped into California from other States. Owing to heavy local production, surpluses of other minerals and mineral materials, which include cement, diatomite, magnesia, salines, talc, mercury, lump iron ore, and some special sands, were supplied to other States. California was an important supplier of tungsten concentrate, molybdenum concentrate, chromite, and rare-earth metal (cerium group) concentrate for other States. Nevada talc and soapstone was shipped to California grinding plants.

Imports and Exports.—The State refractory materials requirements necessitated importation of considerable quantities of refractory chromite, as California chromite is largely unsuited for this use. Similarly, bauxite and kyanite (both high-alumina materials consumed in manufacturing refractories) were imported. Gypsum from Lower California supplemented local output in the cement industry. Imports also included crude petroleum. Cement, salt, and petroleum products were exported, particularly to the United States Territorial possessions.

EMPLOYMENT IN MINERAL INDUSTRIES

Employment.—Table 5 shows fluctuations in employment in California mineral industries during recent years.

TABLE 5.—Estimated number of wage and salary workers in the mineral-extraction industry, 1945–49 (average) and 1950–54 [1]

Year	Metal mining	Crude-petroleum and natural-gas production	Nonmetallic mining and quarrying	Total mineral-extraction industry
1945–49 (average)	3,500	25,000	5,200	33,700
1950	3,100	23,300	5,800	32,200
1951	3,400	25,000	6,600	35,000
1952	[2] 3,300	26,100	[2] 6,600	[2] 36,000
1953	[2] 3,200	[2] 27,400	[2] 6,600	[2] 37,200
1954	3,000	26,800	6,400	36,200

[1] Data from Division of Labor Statistics and Research, California Department of Industrial Relations, in cooperation with the Bureau of Labor Statistics.
[2] Revised.

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Accidents.—No major disaster occurred in any California mineral industry during 1954. Total injuries in the mineral-extraction industries decreased 16 percent, while employment in these activities declined only 3 percent. Accident statistics for 1953 and 1954 are shown in table 6.

TABLE 6.—Fatal and nonfatal disabling work injuries, mineral extraction industry, 1953–54 [1]

Industry	1953			1954			Disabling work injuries per 1,000 workers [2]	
	Fatal	Nonfatal	Total	Fatal	Nonfatal	Total	1953	1954
Metal mining	5	434	439	6	407	413	[3] 137	138
Crude-petroleum and natural-gas production	12	946	958	6	778	784	89	74
Oil-and gas-field contract services	10	1,466	1,476	10	1,196	1,206		
Rock, sand and gravel quarrying	4	492	496	3	424	427	[3] 97	84
Other nonmetallic mining and quarrying	2	145	147	4	104	108		
Total mineral extraction	33	3,483	3,516	29	2,909	2,938	[3] 94	81

[1] State of California Department of Industrial Relations, Division of Labor Statistics and Research: California Work Injuries, 1954.
[2] A disabling work injury is defined as one which causes disability beyond the day of the accident.
[3] Corrected.

Wages.—Data furnished by the State of California Department of Public Relations, through the Bureau of Labor Statistics, on wages in the mineral-extraction industry in 1954, with comparative figures for 1953 and 1952 in parentheses, follow: Average hourly earnings in metal mining were $1.95 ($1.90) ($1.79), and average weekly earnings were $86.65 ($83.18) ($77.70); in crude-petroleum and natural-gas production, average hourly earnings, $2.37 ($2.33) ($2.16) and average weekly earnings $94.26 ($92.33) ($85.89); in nonmetallic mining and quarrying, $2.23 ($2.14) ($2.02) hourly, and $91.72 ($89.30) ($83.12) weekly.

GOVERNMENT ASSISTANCE

Defense Minerals Exploration Administration Program.—The DMEA program, designed to provide Government aid in finding new sources of strategic and critical minerals in the United States, included contracts for $1,564,290 for development of the 22 projects active in California for all or part of 1954. The Government participation in these projects was $1,042,581. Five projects were initiated during the year. Of these, 2 were tungsten deposits, 1 chromium, 1 iron, and 1 nickel.

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TABLE 7.—Defense Minerals Exploration Administration projects, initiated or still active in 1954

Operator	Status	Property	County	District or area	Commodity	Government participation, percent	Total contract
William C. Morrison & Sons	A	Valpine	Alpine	Hope Valley	Tungsten	75	$16,000
Helmke, Thomas and Janssen	A	Lambert	Butte	Magalia	Chromium	50	36,500
New Penn Mines, Inc	B	Penn	Calaveras	West Belt (Campo Seco)	Copper-zinc	50	169,122
Jonas & Johnson	B	Mount Diablo	Contra Costa	Mount Diablo	Mercury	75	73,571
Providence-Tuolumne Gold Mines	C	Copper Bluff	Humboldt	Hoopa	Copper-zinc	50	28,820
Red Cloud Mining Co. (H. E. Briggs)	C	Red Cloud	Inyo	South Park	Lead-zinc	50	17,310
L. D. Foreman	B	Defense	do	Modoc	do	50	12,240
Northfield Mines, Inc	C	Adamson	do	Bishop (Pine Creek)	Tungsten	75	57,361
Abaca Mining Co	C	Big Oscar	Kern	Kernville	Antimony	75	7,500
Walabu Mining Co	B	Walabu (Cuddeback)	do	Keene	Mercury	75	26,000
California Quicksilver Mines, Inc	B	Abbott	Lake	Sulphur	do	75	88,940
Strawberry Tungsten Mines, Inc	B	Strawberry	Madera	Jackass	Tungsten	75	18,648
Incline Mining Co	A	Blue Dipper	Mariposa	East Belt	do	75	7,500
Wah Chang Mining Corp (Black Rock Mining Corp).	B	Black Rock	Mono	Yellow Jacket Spring	do	75	115,000
Lakeview Manganese Mines	B	Iron Dyke-Lakeview-Trail	Plumas	Crescent Mills	Manganese	75	13,000
New Idria Mining & Chemical Co	C	New Idria-West Idria	San Benito	Idria	Mercury	75	365,127
Bessemer Iron Corporation	A	Bessemer	San Bernardino	Lava Bed	Iron	50	10,000
Valle's Mining Syndicate	A	Old Ironside	San Diego	Foster	Nickel	75	31,460
Cordero Mining Co	B	New Almaden	Santa Clara	Almaden	Mercury	75	200,828
Glidden Co	B	Bully Hill	Shasta	Bully Hill	Copper-zinc	50	256,344
Keystone Asbestos Corp	B	Trinity group	Shasta-Trinity	Tamarack Lake	Asbestos (chrysotile).	90	10,009
Do	B	Calethia group	Siskiyou	Scott River (Callahan)	do	90	3,010

A, Initiated in 1954.
B, Initiated before but active in 1954.
C, Initiated before and amended in 1954.

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REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—No production of antimony from antimony ore was reported in California in 1954. Assessment work was the only activity, due to low market prices for the ore. An undetermined quantity of antimony in California precious-metal and base-metal ores, particularly lead ore, was recovered at smelters.

Cadmium.—Zinc concentrate shipped from the Coso district, Inyo County, to a zinc smelter contained a recoverable but undetermined quantity of cadmium.

Chromite.—The State chromite output, second to Montana in the Nation in 1954, exceeded the 1953 yield by 16 percent in quantity and 10 percent in value. All but a very small percentage of this output was received by the Grants Pass, Oreg., Government Purchase Depot. Of the total production, 67 percent was concentrate and 33 percent ore in 1954, as compared with 62 percent of concentrate and 38 percent of ore in 1953. Peak output of chromite in California in recent years was 62,500 tons produced in 1943.

TABLE 8.—Shipments of chromite ore and concentrate, by counties, in 1954

County	Active mines and prospects	Rank in State (by value)	Milling ore treated [1] gross (long tons)	Material shipped (dry weight, long tons)					Total value
				Total wet weight (long tons)	Under 45 percent Cr_2O_3		Over 45 percent Cr_2O_3		
					Ore	Concentrate	Ore	Concentrate	
Alameda	3	11	2,782	380				343	$35,326
Butte	2	5	4,275	1,441		1,320	6	19	107,331
Colusa	1	20		(2)	(2)				(2)
Del Norte	43	3	799	3,692	1,608	117	1,753	138	335,701
El Dorado	3	10	410	401	41	86	182	74	35,457
Fresno	3	4	7,340	2,591		195	144	2,019	243,006
Glenn	7	12	1,024	411		8	36	335	34,953
Humboldt	3	15		101	25		76		8,162
Lake	3	8	1,741	504		91	28	335	38,972
Napa	5	7	810	436	75	6	154	183	44,805
Placer	3	16		58			56		7,814
Plumas	1	19		(2)	(2)		(2)		(2)
San Benito	1	18	115	33				30	4,454
San Luis Obispo	10	1	30,976	12,026	173	7,705	198	2,941	898,239
Santa Barbara	2	13	38	171		8	154	6	20,132
Santa Clara	2	14	754	103				93	9,582
Shasta	1	21		(2)	(2)				(2)
Siskiyou	33	2	1,446	3,420	531	14	2,360	452	345,008
Tehama	10	6	1,440	806	34	253	265	212	71,994
Trinity	10	9	1,012	448	69	304	68	6	35,463
Tuolumne	2	17		310	310				5,258
Undistributed				44	34		6		3,593
Total	148								2,285,250
Long tons			54,962	27,376	2,900	10,107	5,486	7,186	
Short tons			61,557	30,661	3,248	11,320	6,144	8,048	

[1] Partly estimated.
[2] Included with "Undistributed" to avoid disclosure of individual output.

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The following 5 leading producers of chromite shipped 51 percent of the State total in 1954, in terms of chromic oxide content: Castro Mining Co., Castro mine, Santa Lucia district, San Luis Obispo County (concentrate); J. R. Holman, Mistake mine, Coalinga district, Fresno County (concentrate); Pierce Bros., Hard Face group, Santa Lucia district, San Luis Obispo County (concentrate); Ruth Robertson, Cyclone Gap mine, Preston Peak district, Siskiyou County (ore); and Helmke, Thomas & Janssen, Lambert (Magalia) mine, Magalia district, Butte County (concentrate). A total of 138 producers operating 149 mines and prospects were reported in 1954 against 86 and 97, respectively, in 1953.

Copper.—California copper production was the lowest recorded since the depression year 1934 and decreased 5 percent in quantity and 3 percent in value below the minor yield of 1953. Straight copper ore was the source of 55 percent of the 1954 copper output and 45 percent was a byproduct, largely from lead-zinc and tungsten ores. Principal producers of copper from copper ore were: The Volo Mining Co., Copper Hill mine, Amador County; H. J. Buchenau, Jessie Belle mine, Madera County; Noonday Copper Mining Co., Noonday mine, El Dorado County; and New Trail Mining Co., New Trail mine, San Bernardino County. The United States Vanadium Co. was an important producer of byproduct copper from tungsten ore milled at the Pine Creek mine, Bishop district, Inyo County. Exploration under DMEA loans was active in the copper-zinc deposits of the Hoopa district, Humboldt County, and the Bully Hill district, Shasta County.

Gold.—Gold increased over 1 percent in quantity and value above 1953 after declining steadily for the three previous years. Placer mines furnished 59 percent of the total gold (53 percent in 1953) and lode mines 41 percent (47 percent in 1953). The following 5 leading gold-producing properties supplied 83 percent of total output: Yuba Consolidated Gold Fields, Yuba County (dredging); Natomas Company, Sacramento County (dredging); Empire Star Mines Co., Ltd., and Idaho Maryland Mines Corp., both in Nevada County (gold ore); and Siskon Corp., Siskiyou County (gold ore).

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TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties, in terms of recoverable metals

County	Mines producing [1]		Gold					
			Lode		Placer		Total	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Amador	5	7	528	$18,480	164	$5,740	692	$24,220
Butte		6			130	4,550	130	4,550
Calaveras	8	6	176	6,160	648	22,680	824	28,840
El Dorado	8	4	6,249	218,715	60	2,100	6,309	220,815
Fresno		4			179	6,265	179	6,265
Imperial and San Diego [2]	2	1	[3] 58	[3] 2,030	29	1,015	[3] 87	[3] 3,045
Inyo	22		766	26,810			766	26,810
Kern	8	2	5,672	198,520	23	805	5,695	199,325
Los Angeles	1	2	(3)	(3)	196	6,860	[3] 196	[3] 6,860
Madera	3	3	228	7,980	25	875	253	8,855
Mariposa	14	2	353	12,355	59	2,065	412	14,420
Merced		(4)			5	175	5	175
Mono	3		199	6,965			199	6,965
Nevada	5	9	56,203	1,967,105	513	17,955	56,716	1,985,060
Orange	1		2	70			2	70
Placer	1	14	2	70	470	16,450	472	16,520
Plumas	2	4	(3)	(3)	253	8,855	[3] 253	[3] 8,855
Riverside	3		6	210			6	210
Sacramento	1	8	(3)	(3)	61,823	2,163,805	[3] 61,823	[3] 2,163,805
San Bernardino	12	4	391	13,685	817	28,595	1,208	42,280
Shasta	7	2	121	4,235	56	1,960	177	6,195
Sierra	9	15	12,797	447,895	586	20,510	13,383	468,405
Siskiyou	5	5	13,885	485,975	86	3,010	13,971	488,985
Stanislaus		(4)			4	140	4	140
Trinity	4	7	12	420	6,114	213,990	6,126	214,410
Tuolumne	7	1	41	1,435	1	35	42	1,470
Yuba		4			67,956	2,378,460	67,956	2,378,460
Total	131	110	97,689	3,419,115	140,197	4,906,895	237,886	8,326,010

County	Silver					
	Lode		Placer		Total	
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Amador	3,271	$2,960	21	$19	3,292	$2,979
Butte			26	24	26	24
Calaveras	90	81	56	51	146	132
El Dorado	5,081	4,599	9	8	5,090	4,607
Fresno			27	24	27	24
Imperial and San Diego [2]	[3] 294	[3] 266	5	5	[3] 299	[3] 271
Inyo	234,254	212,012			234,254	212,012
Kern	14,060	12,725	5	5	14,065	12,730
Los Angeles	(3)	(3)	28	25	[3] 28	[3] 25
Madera	920	833	8	7	928	840
Mariposa	220	199	7	6	227	205
Merced						
Mono	1,953	1,768			1,953	1,768
Nevada	15,661	14,174	72	65	15,733	14,239
Orange	632	572			632	572
Placer	2	2	44	40	46	42
Plumas	(3)	(3)	30	27	[3] 30	[3] 27
Riverside	42	38			42	38
Sacramento	(3)	(3)	2,612	2,364	[3] 2,612	[3] 2,364
San Bernardino	3,657	3,310	175	158	3,832	3,468
Shasta	28	25	5	5	33	30
Sierra	2,539	2,298	73	66	2,612	2,364
Siskiyou	18,950	17,151	10	9	18,960	17,160
Stanislaus						
Trinity	6	5	646	585	652	590
Tuolumne	6	5			6	5
Yuba			4,050	3,665	4,050	3,665
Total	301,666	273,023	7,909	7,158	309,575	280,181

See footnotes at end of table.

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TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties, in terms of recoverable metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Amador	134,400	$39,648	2,300	$315			$67,162
Butte							4,574
Calaveras							28,972
El Dorado	98,800	29,146	72,300	9,905	43,300	$4,676	269,149
Fresno							6,289
Imperial and San Diego [3]	[3] 1,500	[3] 442					[3] 3,758
Inyo	224,600	66,257	5,253,200	719,688	2,771,100	299,279	1,324,046
Kern							212,055
Los Angeles							[3] 6,885
Madera	87,400	25,783			100	11	35,489
Mariposa			800	110	600	65	14,800
Merced							175
Mono							8,733
Nevada	4,400	1,298					2,000,597
Orange	100	30	1,300	178	7,900	853	1,703
Placer							16,562
Plumas	(2)	(2)					[3] 8,882
Riverside	600	177	800	110			535
Sacramento							[3] 2,166,169
San Bernardino	90,200	26,609	10,500	1,438	5,800	626	74,421
Shasta	71,200	21,004					27,229
Sierra					1,200	130	470,899
Siskiyou			800	110			506,255
Stanislaus							140
Trinity	10,800	3,186					218,186
Tuolumne							1,475
Yuba							2,382,125
Total	724,000	213,580	5,342,000	731,854	2,830,000	305,640	9,857,265

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[2] Combined to avoid disclosure of individual output.
[3] Los Angeles, Plumas, and Sacramento Counties lode gold, silver, and copper combined with Imperial and San Diego Counties to avoid disclosure of individual output.
[4] From property not classed as a mine.

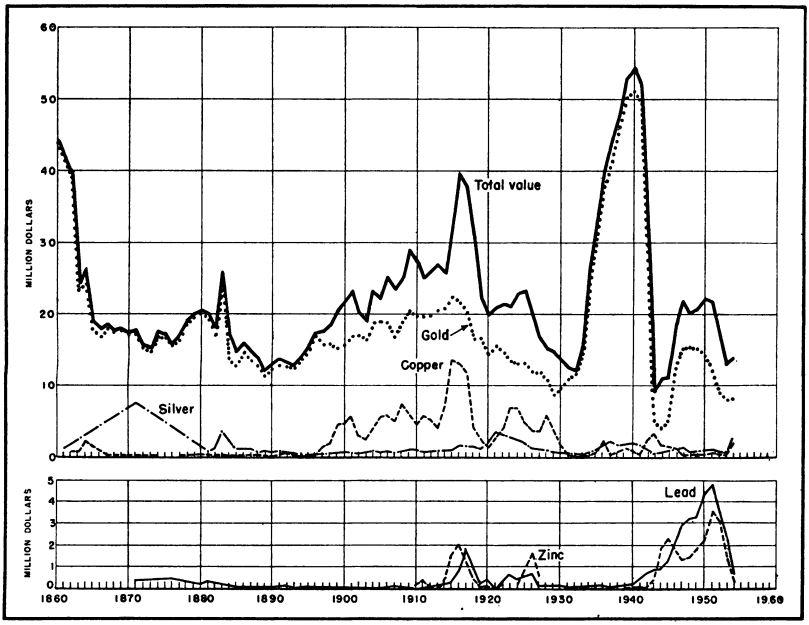

FIGURE 2.—Value of mine production of gold, silver, copper, lead, and zinc and total value in California, 1860–1954.

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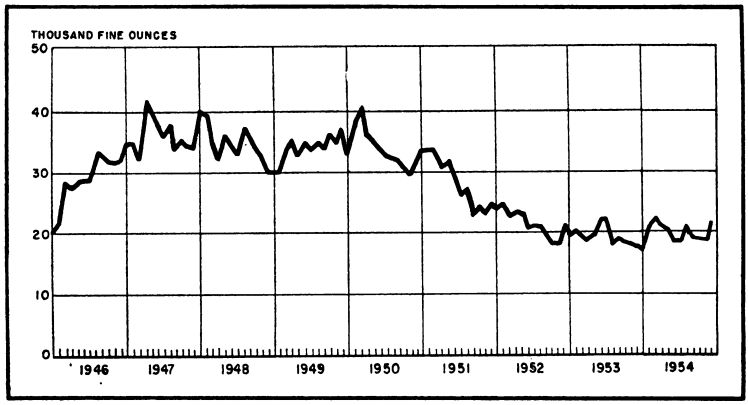

FIGURE 3.—Mine production of gold in California, 1946–54, by months, in terms of recoverable gold.

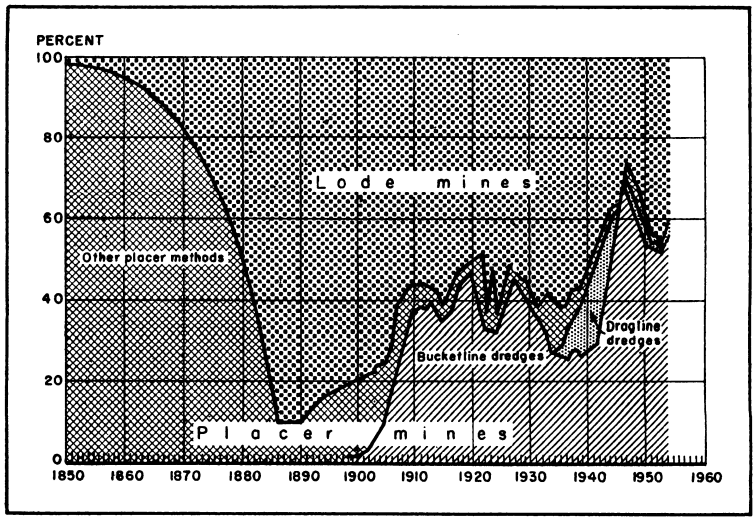

FIGURE 4.—Percentage of total California gold produced at lode and placer mines and by various methods of placer mining, 1850–1954.

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TABLE 10.—Gold production at placer mines, 1945–49 (average), 1950–54, and total, 1848–1954, by classes of mines and methods of recovery [1]

Class and method	Mines producing [2]	Washing plants (dredges)	Material treated (cubic yards)	Gold recovered		
				Fine ounces	Value	Average value per cubic yard
Surface placers:						
Gravel mechanically handled:						
Bucketline dredges:						
1945–49 (average)	20	32	76,542,020	217,634	$7,617,197	$0.100
1950	14	26	82,514,000	223,164	7,810,740	.095
1951	13	25	68,714,600	175,870	6,155,450	.090
1952	6	16	49,881,800	131,806	4,613,210	.092
1953	3	14	45,528,800	119,022	4,165,770	.091
1954	3	15	44,910,720	134,096	4,693,360	.105
Dragline dredges: [3]						
1945–49 (average)	28	26	3,276,200	15,287	535,052	.163
1950	16	14	3,417,900	15,499	542,465	.156
1951	13	11	1,363,000	6,652	232,820	.166
1952	7	7	1,447,700	6,655	232,925	.161
1953	8	7	302,600	935	32,725	.107
1954	9	9	179,400	1,466	51,310	.286
Suction dredges:						
1945–49 (average)	5	5	86,580	483	16,898	.195
1950	16	13	263,300	1,407	49,245	.187
1951	13	9	180,500	717	25,095	.139
1952	9	9	74,100	305	10,675	.144
1953	7	8	87,700	341	11,935	.136
1954	3	3	3,800	53	1,855	.488
Nonfloating washing plants: [3 4]						
1945–49 (average)	17	17	322,400	2,415	84,539	.204
1950	30	30	76,500	3,293	115,255	1.295
1951	16	16	99,900	2,210	77,350	.562
1952	18	18	11,600	1,462	51,170	2.040
1953	24	24	40,800	1,143	40,005	.486
1954	24	24	8,820	2,298	80,430	.836
Gravel hydraulically handled:						
1945–49 (average)	22	----------	373,700	1,327	46,438	.124
1950	32	----------	383,400	1,468	51,380	.134
1951	13	----------	55,000	440	15,400	.280
1952	9	----------	53,100	409	14,315	.270
1953	16	----------	216,200	469	16,415	.076
1954	8	----------	43,600	235	8,225	.189
Small-scale hand methods: [5]						
1945–49 (average)	72	----------	346,592	4,992	174,706	.504
1950	59	----------	204,050	3,029	106,015	.520
1951	43	----------	59,200	1,513	52,955	.895
1952	48	----------	51,900	1,576	55,160	1.063
1953	53	----------	76,500	1,271	44,485	.583
1954	46	----------	119,800	1,802	63,070	.526
Underground placers:						
Drift:						
1945–49 (average)	8	----------	5,080	241	8,428	1.659
1950	19	----------	9,500	443	15,505	1.632
1951	10	----------	2,800	222	7,770	2.775
1952	11	----------	3,700	130	4,550	1.230
1953	12	----------	3,330	165	5,775	1.734
1954	17	----------	6,580	247	8,645	1.314
Grand total placers:						
1945–49 (average)	173	----------	80,952,572	242,379	8,483,258	.105
1950	186	----------	86,868,650	248,303	8,690,605	.100
1951	121	----------	70,475,000	187,624	6,566,840	.093
1952	108	----------	51,523,900	142,343	4,982,005	.097
1953	123	----------	46,255,930	123,346	4,317,110	.093
1954	110	----------	45,272,720	140,197	4,906,895	.108
1848–1954	----------	----------	[6]	67,223,249	1,488,551,361	[6]

[1] For historical data by years, see Minerals Yearbook, Review of 1940, p. 219.
[2] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[3] Includes commercial rock plants and tungsten mines that produced byproduct gold from gravels; byproduct gold is included with gold recovered, but material treated and average value per cubic yard refer only to straight gold dredging.
[4] Includes all placer operations using power excavator and washing plants, both on dry land; when washing plant is movable outfit is termed "dry-land dredge."
[5] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, rockers, dry washers, etc.
[6] Complete data not available.

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TABLE 11.—Mine production of gold, silver, copper, lead, and zinc 1945–49 (average), 1950–54, and total, 1848–1954, in terms of recoverable metals [1]

Year	Mines producing [2]		Material sold or treated (short tons) [3]	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945–49 (average)	186	173	603,241	354,976	$12,424,167	1,087,108	$919,535
1950	243	186	547,241	412,118	14,424,130	1,071,917	970,139
1951	173	121	494,151	339,732	11,890,620	1,145,219	1,036,481
1952	141	108	424,783	258,176	9,036,160	1,099,658	995,246
1953	150	123	390,583	234,591	8,210,685	1,036,372	937,969
1954	131	110	231,517	237,886	8,326,010	309,575	280,181
1848–1954			(4)	104,633,841	2,364,288,087	115,968,922	94,172,048

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	2,850	$919,374	9,331	$2,566,130	6,950	$1,694,998	$18,524,204
1950	646	268,736	15,831	4,274,370	7,551	2,144,484	22,081,859
1951	921	445,764	13,967	4,832,582	9,602	3,495,128	21,700,575
1952	800	387,200	11,199	3,606,078	9,419	3,127,108	17,151,792
1953	382	219,268	8,664	2,269,968	5,358	1,232,340	12,870,230
1954	362	213,580	2,671	731,854	1,415	305,640	9,857,265
1848 1954	632,472	204,303,812	241,492	45,782,777	131,501	30,677,808	2,739,224,532

[1] Includes recoverable metal content of gravel washed (placer operations); ore milled; old tailings or slimes re-treated; tungsten ore; and ore, old tailings, slag, flue dust, and pyritic ore residue shipped to smelters during calendar year indicated.
[2] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[3] Does not include gravel washed.
[4] Figure not available.

TABLE 12.—Mine production of gold, silver, copper, lead, and zinc in 1954, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	16,542	67,858	23	690	551
February	21,030	72,546	33	914	755
March	22,698	10,820	24	53	3
April	20,914	11,858	26	43	3
May	20,161	9,772	19	69	9
June	18,581	16,590	18	162	13
July	18,368	12,855	15	102	9
August	20,951	19,410	25	138	11
September	19,302	17,188	34	99	13
October	19,193	21,368	71	147	16
November	18,996	25,585	44	163	16
December	21,150	23,725	30	91	16
Total	237,886	309,575	362	2,671	1,415

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TABLE 13.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed, and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation:					
Ore	[1] 51,278	9,517	----------	----------	----------
Old tailings	371	100	----------	----------	----------
Total	51,649	9,617	----------	----------	----------
Cyanidation:					
Ore	31,946	39,428	----------	----------	----------
Total	31,946	39,428	----------	----------	----------
Total recoverable in bullion	[1] 83,595	49,045	----------	----------	----------
Concentration, and smelting of concentrates:					
Ore [2]	13,153	140,583	541,700	2,879,200	2,456,800
Total	13,153	140,583	541,700	2,879,200	2,456,800
Direct smelting:					
Ore	820	109,646	111,100	2,415,600	329,700
Old tailings and copper precipitates [3]	57	2,327	71,200	47,200	43,500
Old slag	64	65	----------	----------	----------
Total	941	112,038	182,300	2,462,800	373,200
Placer	140,197	7,909	----------	----------	----------
Grand total	237,886	309,575	724,000	5,342,000	2,830,000

[1] Includes gold recovered and sold as "natural gold."
[2] Includes tungsten-ore concentrate.
[3] Combined to avoid disclosure of individual output.

TABLE 14.—Mine production of gold, silver, copper, lead, and zinc in 1954, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	92	194,841	96,387	57,744	32,100	73,900	45,100
Dry silver	6	961	7	7,676	500	60,800	37,400
Total	98	195,802	96,394	65,420	32,600	134,700	82,500
Copper	10	8,510	491	7,610	396,000	2,300	----------
Lead	12	4,799	72	63,450	4,600	1,624,100	78,400
Lead-zinc	2	21,381	163	141,123	41,900	3,526,700	2,593,400
Zinc	4	122	4	3,291	200	7,000	32,200
Total	28	[r] 34,812	730	215,474	442,700	5,160,100	2,704,000
Other "lode" material:							
Old tailings [2]	10	854	428	2,417	----------	47,200	43,500
Copper precipitates and tungsten ore [3] [4]	2	48	73	18,290	248,700	----------	----------
Old slag	1	1	64	65	----------	----------	----------
Total	13	903	565	20,772	248,700	47,200	43,500
Total "lode" material	139	231,517	97,689	301,666	724,000	5,342,000	2,830,000
Gravel (placer operations)	110	(5)	140,197	7,909	----------	----------	----------
Total, all sources	249	----------	237,886	309,575	724,000	5,342,000	2,830,000

[1] Detail will not necessarily add to totals because some mines produce more than one class of material.
[2] Metal recovered, by class of old tailings, as follows: Gold, 62 tons—418 ounces gold, 136 ounces silver; silver, 792 tons—10 ounces gold, 2,281 ounces silver, 47,200 pounds lead, 43,500 pounds zinc.
[3] Combined to avoid disclosure of individual output.
[4] Tungsten ore tonnage not included.
[5] 45,272,720 cubic yards. Does not include material washed at commercial gravel plants and tungsten mines to produce 2,073 ounces of byproduct gold and 316 ounces of byproduct silver included in placer totals.

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TABLE 15.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals

A. For material treated at mills

	Material treated (short tons)	Recoverable in bullion		Concentrate shipped to smelters [1] and recoverable metals					
		Gold (fine ounces)	Silver (fine ounces)	Concentrate (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Amador	3,135	375	80	395	152	3,188	134,400	2,300	
Calaveras	172	120	45	1	3	5			
El Dorado	11,559	1,580	214	744	4,669	4,867	98,800	72,300	43,300
Imperial and San Diego [2]	10	12	8						
Inyo	20,075	205	117	5,572	206	127,929	216,700	2,801,600	2,405,900
Kern	7,517	5,270	13,246	479	397	85			
Los Angeles and Sacramento [2]	10	44	9						
Madera	3,004	94	31	205	134	888	87,400		
Mariposa	913	297	116	18	56	104		800	600
Mono	691	149	1,450	1	23	67			
Nevada	119,687	49,526	12,610	2,089	6,677	3,051	4,400		
Placer	4	2	2						
Plumas	20	2	1						
Riverside	60	2	1	2	1	15		800	
San Bernardino	219	84	34	14	19	49		1,400	5,800
Shasta	171	121	18						
Sierra	27,983	11,843	2,172	104	816	335			1,200
Siskiyou	25,696	13,819	18,880						
Trinity	60	12	5						
Tuolumne	44	38	6						
Total: 1954	221,030	83,595	49,045	9,615	13,153	140,583	541,700	2,879,200	2,456,800
1953	378,276	95,576	24,586	30,524	14,445	688,826	611,700	13,984,200	10,017,700
BY CLASSES OF MATERIAL TREATED									
Dry gold:									
Crude ore	193,332	83,135	48,779	3,152	12,670	8,079	6,500	73,900	45,100
Old tailings	35	371	100						
Dry silver ore	45	1	138	3		427	300	500	400
Copper:									
Crude ore and tungsten ore [2 3]	7,823	88	28	1,239	349	22,817	496,000	2,300	
Lead ore	10			1		30		1,400	100
Lead-zinc ore	19,756			5,209	133	109,192	38,900	2,799,700	2,405,400
Zinc	29			11	1	38		1,400	5,800
Total 1954	221,030	83,595	49,045	9,615	13,153	140,583	541,700	2,879,200	2,456,800
BY CLASSES OF CONCENTRATE SHIPPED TO SMELTERS [1]									
Dry gold				2,693	8,017	3,672	4,400	800	1,800
Copper and copper precipitates [3]				[4] 1,239	[4] 349	[4] 22,817	[4] 496,000	2,300	
Copper-lead-zinc				3		427	300	500	400
Lead				461	4,654	4,469	2,100	75,900	43,800
Lead-zinc				3,166	119	101,597	27,000	2,665,700	296,200
Zinc				2,053	14	7,601	11,900	134,000	2,114,600
Total 1954				9,615	13,153	140,583	541,700	2,879,200	2,456,800

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TABLE 15.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals—Continued

B. For material shipped directly to smelters

	Material shipped (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Amador	1	1	3			
Calaveras	35	53	40			
Inyo	8,228	355	106,208	7,900	2,451,600	365,200
Kern	8	5	729			
Madera	1		1			100
Mono	7	27	436			
Orange	43	2	632	100	1,300	7,900
Plumas and Riverside [2]	42	3	302	2,100		
San Bernardino	2,028	288	3,574	90,200	9,100	
Shasta	48		10	71,200		
Sierra	1	138	32			
Siskiyou	4	66	70		800	
Trinity	40		1	10,800		
Tuolumne	1	3				
Total: 1954	10,487	941	112,038	182,300	2,462,800	373,200
1953	12,307	1,224	315,735	152,300	3,343,800	698,300
BY CLASSES OF MATERIAL						
Dry gold:						
Crude ore	1,509	582	886	25,600		
Old tailings	27	47	36			
Old slag	1	64	65			
Dry silver:						
Crude ore	916	6	7,111	200	60,300	37,000
Old tailings	792	10	2,281		47,200	43,500
Copper:						
Crude ore	687	127	3,045	77,500		
Precipitates	48		10	71,200		
Lead ore	4,789	72	63,420	4,600	1,622,700	78,300
Lead-zinc ore	1,625	30	31,931	3,000	727,000	188,000
Zinc ore	93	3	3,253	200	5,600	26,400
Total 1954	10,487	941	112,038	182,300	2,462,800	373,200

[1] Excludes concentrates treated only by amalgamation and/or cyanidation
[2] Combined to avoid disclosure of individual output.
[3] Tungsten ore tonnage not included with material treated.
[4] Includes concentrate and contained recoverable metal from tungsten ore.

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TABLE 16.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of gross metal content

Class of material	Quantity shipped or treated (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
CONCENTRATE SHIPPED TO SMELTERS						
Dry gold	2,693	8,017	3,672	6,119	875	2,148
Copper and copper precipitates [1]	[2] 1,239	[2] 349	[2] 22,817	[2] 508,921	4,349	----------
Copper-lead-zinc	3	----------	427	354	535	496
Lead	461	4,654	4,469	2,926	76,733	55,239
Lead-zinc	3,166	119	101,597	31,754	2,712,477	374,920
Zinc	2,053	14	7,601	14,009	144,138	2,191,243
Total: 1954	9,615	13,153	140,583	564,083	2,939,107	2,624,046
1953	30,524	14,446	688,936	654,044	14,259,230	10,791,150
ORE, ETC., SHIPPED DIRECTLY TO SMELTERS						
Dry gold:						
Crude ore	1,509	589	900	26,138	88	----------
Old tailings	27	47	36	----------	31	----------
Old slag	1	64	65	10	----------	----------
Dry silver:						
Crude ore	916	6	7,111	227	60,890	46,904
Old tailings	792	10	2,281	----------	47,677	55,046
Copper:						
Crude ore and precipitates [1]	735	127	3,055	152,889	----------	80
Lead:						
Crude ore	4,789	72	63,620	6,069	1,712,646	109,120
Lead-zinc:						
Crude ore	1,625	30	31,931	3,755	734,847	238,031
Zinc:						
Crude ore	93	5	3,391	365	6,011	33,783
Total: 1954	10,487	950	112,390	189,453	2,562,190	482,964
1953	12,307	1,225	315,986	160,040	3,408,740	923,206

[1] Combined to avoid disclosure of individual output.
[2] Includes concentrate and contained metal from tungsten ore.

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TABLE 17.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties and districts, in terms of recoverable metals [1]

County and district	Mines producing [2]		Lode material (short tons)	Gold (fine ounces)			Silver (lode and placer, [3] fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total					
Amador County:											
East Belt [4]	3	2	273	80	33	113	35				$3,986
Mokelumne River		3			27	27	3				948
Mother Lode [5]	1	1	42	323	11	334	66				11,750
Butte County:											
Honcut		(6)			7	7					245
Limpkin		(6)			1	1					35
Oroville		1			67	67	6				2,351
Yankee Hill		2			30	30	6				1,055
Calaveras County:											
East Belt [4]	5		80	40	19	59	18				2,081
Mother Lode [5]	3	4	127	65	251	316	67				11,121
West Belt [7]		2		71	378	449	61				15,770
El Dorado County:											
American River (Folsom) [8]		(6)			6	6					210
East Belt [4]	1	1	9,500	6,219	4	6,223	4,606	2,100	72,300	43,300	237,175
Mother Lode [5]	6	3	1,705	27	49	76	432	84,000			27,831
Fresno County:											
Kings River		1			3	3					105
San Joaquin		3			176	176	27				6,184
Imperial County:											
Cargo Muchacho		(6)			5	5					175
Mesquite		(6)			19	19	4				669
Inyo County:											
Lee	3		1,675	31		31	34,622	3,100	732,300	206,400	155,950
Modoc	2		1,703	31		31	43,675	2,800	719,500	30,500	143,304
Resting Springs	2		40	7		7	438	600	500	400	930
South Park	3		139	130		130	113		1,100		4,803
Kern County:											
Kern River		(6)			12	12	4				424
Mojave	5		6,536	4,783		4,783	13,863				179,952
Randsburg [9]	3	2	989	888	11	899	197				31,643
Los Angeles County:											
San Gabriel		2			196	196	28				6,885
Madera County:											
Minerets	1		1				1			100	12
Mariposa County:											
East Belt [4]	5		821	313		313	209		800	600	11,319
Mother Lode [5]	8	2	88	38	59	97	17				3,410
West Belt [7]	1		4	2		2	1				71
Merced County:											
Merced River		(6)			5	5					175

See footnotes at end of table.

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TABLE 17.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties and districts, in terms of recoverable metals [1]—Continued

County and district	Mines producing [2]		Lode material (short tons)	Gold (fine ounces)			Silver (lode and placer, [3] fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total					
Mono County:											
Mammoth Lakes	1		92	60		60	761				$2,789
Nevada County:											
Grass Valley-Nevada City	4	2	119,652	56,166	20	56,186	15,657	4,400			1,981,979
Washington (North Bloomfield)	1	4	35	37	365	402	58				14,122
Orange County:											
Santa Rosa	1		43	2		2	632	100	1,300	7,900	1,703
Placer County:											
American River (Folsom) [8]		1			41	41	1				1,436
Auburn		(6)			6	6					210
Colfax		(6)			57	57	4				1,999
Iowa Hill		5			113	113	16				3,969
Last Chance	1	3	4	2	132	134	14				4,703
Michigan Bluff		1			15	15	1				526
Plumas County:											
Granite Basin		(6)			1	1					35
La Porte		(6)			87	87	6				3,050
Quincy		(6)			5	5	1				176
Rich		(6)			2	2					70
Riverside County:											
Dale	1		20	2		2	1				71
Sacramento County:											
American River (Folsom) [8]	1	7	(10)	(10)	61,795	[11] 61,795	[11] 2,609				[11] 2,165,186
San Bernardino County:											
Providence	2		28	35		35	59	100	1,500		1,512
Randsburg [9]	1	4	74	24	812	836	180				29,423
Signal	2		44	8		8	111	200	7,400		1,454
San Diego County: (See Undistributed.)											
Shasta County:											
Cottonwood Creek		(6)			6	6	1				211
Dog Creek		(6)			1	1					35
Flat Creek	1		48				10	71,200			21,013
French Gulch	1		50	2		2					70
Igo	1		30	16	4	20	3				703
Sierra County:											
Alleghany	6	6	20,641	8,298	185	8,483	1,681			1,200	298,557
Gibsonville		(6)			5	5					175
Siskiyou County:											
Scott River	3	2	24	26	35	61	15		800		2,258
Soda Creek		(6)			1	1					35

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Stanislaus County:											
Stanislaus River		(6)			2	2					70
Tuolumne River		(6)			2	2					70
Trinity County:											
New River	1		6	3	2	5	1				176
Trinity River	2	6	90	4	6,107	6,111	649	10,800			217,658
Tuolumne County:											
East Belt [4]	4		40	23		23	6				810
Mother Lode [5]	3	1	5	18	1	19					665
Yuba County:											
Camptonville		(6)			12	12					420
Challenge		(6)			3	3					105
Smartville		(6)			13	13	1				456
Yuba River		3			67,916	67,916	4,047				2,380,722
Undistributed [12]	42	36	66,868	19,915	1,082	20,997	184,551	544,600	3,804,500	2,539,600	1,853,074
Total	131	110	231,517	97,689	140,197	237,886	309,575	724,000	5,342,000	2,830,000	9,857,265

[1] Only those districts are shown separately for which Bureau of Mines is at liberty to publish figures; other producing districts are listed in footnote 12 and their output grouped as "Undistributed."
[2] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[3] Source of total silver as follows: 301,666 ounces from lode mines and 7,909 ounces from placer mines.
[4] East Belt district lies in Amador, Calaveras, El Dorado, Mariposa, and Tuolumne Counties.
[5] Mother Lode district lies in Amador, Calaveras, El Dorado, Mariposa, and Tuolumne Counties.
[6] From property not classed as a mine.
[7] West Belt district lies in Amador, Calaveras, El Dorado, Madera, and Mariposa Counties.
[8] American River (Folsom) district lies in El Dorado, Placer, and Sacramento Counties.
[9] Randsburg district lies in Kern and San Bernardino Counties.
[10] Included with "Undistributed" to avoid disclosure of individual company operations.
[11] Exclusive of lode output which is included with "Undistributed."
[12] Includes the following districts: Cosumnes River and West Belt, Amador County; Butte Creek, Forbestown, and Magalia, Butte County; West Belt, El Dorado County; Pichacho and Pot Hole, Imperial County; Bishop, Chloride Cliff, Coso, Fish Springs, Ubehebe, and Wild Rose, Inyo County; Greenhorn Mountain, Kern County; Cedar, Los Angeles County; Fresno River, Hildreth, and West Belt, Madera County; Masonic and Mount Patterson, Mono County; French Corral and You Bet, Nevada County; Dutch Flat, Forest Hill, and Rocklin, Placer County; Genesee, Greenville, Johnsville, and Sawpit Flat, Plumas County; Chuckawalla, Eagle Mountain, and Gold Park, Riverside County; American River (Folsom) and Cosumnes River, Sacramento County; Barstow, Black Hawk, Buckeye, Dale, Ivanpah, Silurian, and Whipple Mountains, San Bernardino County; Julian, San Diego County; Redding and Shasta, Shasta County; Downieville, Pike (Indian Hill), and Poker Flat (Port Wine), Sierra County; Klamath River, Salmon River, and Yreka, Siskiyou County; Cinnabar and Harfork, Trinity County; Strawberry, Yuba County.

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Iron, Steel, and Iron Ore.—The State iron-ore output dropped 25 percent compared with 1953, owing largely to the downward fluctuation in steel production and the increased use of scrap. Virtually all the production was supplied by the Kaiser Steel Corp. Eagle Mountain open-pit mine in the Eagle Mountain district, Riverside County. Nearly half of the material shipped to the Kaiser Steel Corp. Fontana smelter was beneficiated hematite-magnetite ore treated in a heavy-medium plant at the mine. A small quantity of magnetite ore was shipped from Shasta County for use as heavy aggregate. Shipments of usable iron ore in 1954 averaged 56.3 percent iron content, compared with 53.6 in 1953. Columbia-Geneva Steel Division, United States Steel Corp., operated open hearths and rolling mills at Pittsburg and Torrance, and the Bethlehem Pacific Coast Steel Corp. processed steel at San Francisco. United States Steel also received a substantial percentage of its Utah plants' steel output in coil form, which was cold-rolled into sheets locally. A tinplating plant also was operated. Electric furnaces were operated by both companies in the Los Angeles area, using largely scrap iron to which was added pig iron produced outside of California. Pacific States Steel Co. at Niles and Judson Steel Corp. at Emeryville operated open-hearth furnaces and rolling mills.

TABLE 18.—Iron ore and other metallic materials consumed and pig iron produced, 1945–49 (average) and 1950–54, in net tons

Year	Iron and manganiferous iron ores		Sinter [1]	Miscellaneous	Total	Pig iron produced
	Domestic	Foreign				
1945–49 (average)	362,347	3,945	281,161	68,520	715,973	395,312
1950	585,085	67	430,825	116,308	1,132,285	660,463
1951	862,977	----------	623,836	121,854	1,608,667	921,695
1952	952,606	----------	612,356	172,227	1,737,189	977,121
1953	987,471	----------	805,938	150,504	1,943,913	1,095,118
1954	752,766	----------	650,609	134,768	1,538,143	860,162

[1] Excludes recycled materials.

Lead.—State production of lead fell 69 percent in quantity and 68 percent in value from 1953 chiefly because the Anaconda Copper Mining Co., the principal producer of the metal in the State, closed the Darwin group of mines in the Coso district, Inyo County, for the greater part of the year, owing to low lead prices. Renewed interest developed as the price of lead rose from 13.5 cents per pound in the early part of the year to 15 cents a pound at the end. Shipments of lead-bearing mill tailings, dump ore, lead ore from mines in the small-producer class, and miscellaneous ores smelted were sources of the small percentage of lead production not supplied by the output of the major producer. Foreman & Foreman, operator of the Defense mine, Modoc district, Inyo County, was one of the most consistent shippers of lead ore in the small-producer category.

Manganese.—Production of manganese ore and concentrate decreased sharply in 1954 from 1953. Less than 1,000 short tons of

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commercial-grade manganese and manganiferous ore and concentrate from 3 mines was shipped in 1954, compared with 6,000 tons in 1953. The material was shipped chiefly to battery plants and Government high-grade stockpiles, with minor quantities shipped for chemical use. The three shippers were Teekay Mines, Inc., operator of the Ladd mine, San Joaquin County; K. P. F. & F. Mining Co. Blue Jay mine, Trinity County; and Lange Bros. Sand and Gravel Co. Grandview mine, Lake County. Teekay Mines, Inc., treated ore at the company mill near Tracy and produced a battery-grade concentrate.

Government purchases of manganese and manganiferous ores for low-grade stockpiles and not credited to production increased sharply over 1953. Material in this category was shipped from 58 mines and prospects by 68 operators. Manganese ore and concentrate shipped increased from 3,920 short tons in 1953 to 8,700 in 1954, and manganiferous ore and concentrate rose from 7,800 short tons to 28,100 in 1954. Material containing over 35 percent manganese comprised 2,540 short tons of ore and 6,160 of concentrate. Material shipped that contained less than 35 percent manganese comprised 27,000 short tons of ore and 1,090 of concentrate. Counties that furnished the ore and concentrate, listed in order of output, were: Imperial, Riverside, San Bernardino, San Joaquin, Stanislaus, Trinity, San Louis Obispo, Mendocino, Inyo, San Benito, Mariposa, and Kern. The three principal producing counties, which shipped 89 percent of the total, were Imperial, Riverside, and San Bernardino Counties. L. Mills Beam, operator of the Pioneer mine, Imperial County; Blythe Manganese Co., Inc., Black Jack mine, and Dan Figueroa & Sons, Manganese Canyon and Black Jack mines, Riverside County, were the leading producers.

Because the stockpiled material was to be blended at the low-grade depots and prepared for future beneficiation and eventual consumption, the quantity and value of the annual mine production will not be included in the total mineral production of the State and Nation until upgraded.

Mercury.—Mercury production increased 21 percent in quantity and 66 percent in value over 1953. The average price, quoted at New York, increased from $193.03 in 1953 to $264.39 in 1954, thereby appreciably stimulating production. California continued to dominate domestic output, contributing 61 percent (65 percent in 1953) of the Nation's production. There was activity in cinnabar exploration under DMEA loans in the Mount Diablo district, Contra Costa County; Keene district, Kern County; Sulfur district, Lake County; Idria district, San Benito County; and Almaden district, Santa Clara County.

The 3 leading producers, contributing 87 percent of the State total production, were: New Idria Mining & Chemical Co., New Idria (including San Carlos) mine, San Benito County; Sonoma Quicksilver Mines, Mount Jackson-Great Eastern mine, Sonoma County; and California Quicksilver Mines, Inc., Abbott mine, Lake County. A total of 35 producers operated 32 lode mines and prospects and 3 placer operations in 1954.

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TABLE 19.—Mercury produced in 1954, by counties

County	Producing mines	Ore treated (short tons)	Mercury recovered	
			Flasks (76 pounds)	Value [1]
Fresno	2	575	54	$14,277
Lake	3	10,044	2,207	583,509
Napa	3	400	70	18,507
San Benito	11	44,573	5,255	1,389,370
San Luis Obispo	6	6,388	278	73,500
Santa Clara	2	791	271	71,650
Sonoma	5	57,631	3,106	821,195
Stanislaus	1	120	18	4,759
Other counties [2]	2	23	3	793
Total	35	120,545	[3] 11,262	2,977,560

[1] Value calculated at average price at New York, $264.39 per flask.
[2] Contra Costa and Del Norte.
[3] Includes mercury from dump and placer material treated.

TABLE 20.—Mercury produced, 1945–49 (average) and 1950–54, by methods of recovery

Year	Furnaced [1]		Retorted		Unclassified [2]	Total		Operating mines
	Ore (short tons)	Flasks (76 pounds)	Ore (short tons)	Flasks (76 pounds)	Flasks (76 pounds)	Flasks (76 pounds)	Value [3]	
1945–49 (average)	101,320	13,790	1,227	173	273	14,365	$1,451,324	25
1950	30,479	3,008	571	619	223	3,850	312,851	14
1951	54,316	3,837	1,440	170	275	4,282	899,777	27
1952	82,431	6,992	1,239	202	47	7,241	1,441,683	24
1953	95,325	8,874	1,556	343	73	9,290	1,793,249	28
1954	110,445	10,525	10,100	724	13	11,262	2,977,560	35

[1] Includes ore and mercury from dumps not separable.
[2] Includes mercury recovered from miscellaneous dump material, placer, and cleanup operations.
[3] Value calculated at average price at New York.

Molybdenum.—The United States Vanadium Co. produced molybdenum concentrate as a byproduct of the Pine Creek mine tungsten ore milled at the company Morgan Creek mill in Inyo County. The 1954 shipments decreased 4 percent as compared with 1953.

Platinum.—Less than 200 ounces of platinum was recovered as a byproduct of gold dredging in Sacramento and Yuba Counties, but the output was slightly greater than in 1953.

Rare-Earth Metals.—The Molybdenum Corp. of America was the State's only producer of rare-earth metal concentrates from bastnaesite (fluocarbonate of the rare-earth metals) near Mountain Pass, San Bernardino County. This operation was initiated in 1952. The deposits were described.[2]

Selenium.—Lead-zinc ores of the Coso district contain selenium, some of which is recovered as a byproduct of smelting.

[2] Olson, J. C., Shawe, D. R., Pray, L. C., and Sharp, W. N., Rare-Earth Mineral Deposits of the Mountain Pass District, San Bernardino, Calif.: Geol. Survey Prof. Paper 261, 1955, 75 pp.

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Titanium.—The only titaniferous material shipped was a small quantity of titanium-iron concentrates—used in manufacturing roofing material—from stockpiles of concentrate produced in previous years from beach-sand deposits in Los Angeles County.

Tungsten.—Tungsten-concentrate shipments, in terms of 60 percent WO_3, credited to California mine production increased 45 percent in quantity and 48 percent in value over 1953. Additional concentrate output was derived from ores from other States.

All concentrates reported produced in California were scheelite, but in certain Inyo County ores small quantities of powellite were recovered ultimately as synthetic scheelite. A large percentage of the low-grade tungsten flotation concentrate produced at mills was shipped to chemical digestion plants to produce synthetic scheelite. The United States Vanadium Co. Pine Creek mine, Inyo County, was by far the largest producing tungsten mine in the State and ranked second in the Nation. This company also treated appreciable quantities of custom material in its flotation and chemical digestion plant and led the Nation in shipments of concentrate. The Wah Chang Mining Corp. Black Rock mine, Mono County, was the State's second leading producer followed by Strawberry Tungsten Mines, Inc., Strawberry mine, Madera County; Surcease Mining Co., Atolia group, San Bernardino County; and Brownstone Mining Co., Brownstone claim, Inyo County. The 5 leading shippers of tungsten concentrate furnished 76 percent of the State's total output, the first 3 alone contributing 68 percent. A total of 333 operators producing from 312 mines and prospects reported production in 1954.

TABLE 21.—A. Tungsten concentrate produced in 1954, by counties in which ore was milled

County	Producing mines and prospects	Ore [1]			Concentrates produced (pounds) [1]	Contained WO_3 units
		Mined (short tons)	To mills (short tons)	Milled [2] (short tons)		
Alpine	4	763	763	365	8,757	310
Amador	1	(3)	(3)	(3)	(3)	(3)
Calaveras	2	534	534			
El Dorado	2	7	7	452	2,564	91
Fresno	24	11,784	11,784	11,440	110,870	3,880
Imperial	5	1,643	1,643	143	2,180	74
Inyo	85	269,582	289,556	[4] 345,430	[4] 4,149,891	[4] 146,574
Kern	73	9,412	8,591	7,621	108,376	3,492
Lassen	1	(3)	(3)	(3)	(3)	(3)
Los Angeles				1,718	[1] 15,800	[1] 514
Madera	5	17,911	17,851	17,825	522,224	17,025
Mariposa	1	(3)	(3)	(3)	(3)	(3)
Mono	13	135,405	130,633	73,016	634,681	18,257
Nevada	1	(3)	(3)	(3)	(3)	(3)
Riverside	3	181	181	181	2,995	87
San Bernardino	43	46,618	46,618	44,634	389,561	12,397
San Diego	10	935	935	370	10,313	328
Tulare	38	19,904	19,904	19,136	192,030	6,248
Tuolumne	1	(3)	(3)			
Undistributed		832	332	161	4,899	148
Total	312	515,511	529,332	522,492	6,155,141	209,425

See footnotes at end of table.

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TABLE 21.—B. Production and shipments of tungsten concentrate in 1954 credited to California counties in which ore was mined—Continued

County	Produced [1]		Shipped		
	Pounds	Units	Pounds	Contained WO_3 units	Value [4]
Alpine	17,627	591	17,627	591	$37,044
Calaveras	3,764	125	3,764	125	7,835
El Dorado	790	29	790	29	1,818
Fresno	114,900	4,012	114,900	4,012	251,472
Imperial	12,885	447	12,885	447	28,018
Inyo	3,360,702	118,427	3,420,702	120,558	7,556,575
Kern	121,807	3,819	121,807	3,819	239,375
Madera	522,324	17,028	522,324	17,028	1,067,315
Mariposa	658	18	658	18	1,129
Mono	1,402,244	45,608	1,330,444	43,546	2,729,463
Riverside	2,995	87	2,995	87	5,453
San Bernardino	409,163	13,007	409,163	13,007	815,279
San Diego	19,559	614	19,559	614	38,486
Tulare	204,946	6,639	204,946	6,639	416,133
Undistributed	6,849	223	6,849	223	13,976
Total	6,201,213	210,674	6,189,413	210,743	13,209,371

[1] Partly estimated.
[2] Ore actually milled in county.
[3] Included with "Undistributed" to avoid disclosure of individual company operations.
[4] Includes material from Nevada mines.
[5] Value based on GSA weighted average at San Francisco of $62.68.

Exploration for new tungsten deposits under DMEA loans was conducted in the Hope Valley district, Alpine County; Bishop (Pine Creek) district, Inyo County; Jackass district, Madera County; and the East Belt district, Mariposa County.

Uranium.—Interest in uranium prospecting was intensified as a result of widespread publicity, descriptive of uranium activity in California and elsewhere in the Nation, largely through the instrumentality of press, radio, and television. Literature from professional sources [3] was also made available in 1954. Although prospecting activities were widespread in the State, the greatest attention was focused on the Miracle Springs area of Kern County, which yielded the State's first carload shipment of commercial uranium ore—from the Miracle mine.

Zinc.—Zinc output fell 74 percent in quantity and 75 percent in value in 1954, compared with 1953. The principal production was from the Anaconda Copper Mining Co. Darwin Group of mines in the Coso district, Inyo County. The company operated only 2 months in the year, a major cause of the drop in State output. Metal was recovered at a Montana zinc smelter from zinc concentrate and at Utah smelter-fuming plants from lead ore and concentrate. The remainder of the State zinc output was the relatively small quantity recovered at California and Utah lead smelters equipped with fuming plants that treated lead ore and concentrate and other crude materials, including tailings containing zinc, shipped from small operations. During 1954, zinc recovered from smelter slag at the American Smelting & Refining

[3] State of California, Dept. of Natural Resources, Div. of Mines, Mineral Information Service, vol. 7, No. 9, July 1954, 8 pp.
Moore, G. W., and Stephens, J. G., Reconnaissance for Uranium-Bearing Carbonaceous Rocks in California and Adjacent Parts of Oregon and Nevada: Geol. Survey Circ. 313, 1954, 8 pp.

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Co. Selby plant, Contra Costa County, was derived largely from ore and concentrate of foreign origin.

Exploration for zinc was confined to the locations, described in the paragraphs on copper, where zinc is an associated metal.

NONMETALS

Asbestos.—Interest in the search for and development of asbestos deposits in California continued but with production only on a small scale. Areas explored under DMEA loans in Siskiyou, Shasta, and Trinity Counties did not reveal any important commercial discoveries.

Barite.—The only crude barite sold or used by producers in 1954 was a small tonnage mined in Tulare County and used for experimental purposes. Companies that crushed and ground crude barite mined mostly in Nevada and Arizona principally for use in drilling mud, paint filler, barium chemicals, and glass, included: Barium Products, Ltd., Modesto; Chemical & Pigment Co., Oakland; Baroid Sales Division, National Lead Co., Merced; Industrial Minerals & Chemical Co., Berkeley; Oil Base, Inc., Compton; and Macco Corp., Paramount.

Boron Minerals.—The principal output of boron minerals in 1954 was in Kern County, where Pacific Coast Borax Co. worked its deposits of colemanite and tincal at Boron. This company also produced colemanite in Inyo County. Producers of boron minerals and compounds from brines were: American Potash & Chemical Corp. (borax, boric acid, and anhydrous sodium tetraborate) and West End Chemical Co. (borax), both firms in San Bernardino County. Compared with 1953 the yield of boron minerals and compounds rose 11 percent in quantity and 51 percent in value. Although boron compounds had a wide variety of uses, about half of California's total output (incidentally, the Nation's entire production) was consumed by the glass and ceramics industries.

Bromine.—In 1954 bromine and bromine compounds were produced as byproducts by Westvaco Minerals Products Division, Food Machinery & Chemical Corp., in Alameda County (ethylene dibromide) from slat-works bitterns; and by American Potash & Chemical Corp. from brines of Searles Lake, San Bernardino County (elemental bromine and potassium bromide). The total production of contained bromine increased about 30 percent while value increased 63 percent compared with 1953.

Calcium Chloride.—Calcium chloride was produced in San Bernardino County from well brines and dry-lake brines near Amboy. California Rock Salt Co. and National Chloride Co. of America produced liquid calcium chloride and Hill Bros. Chemical Co. flake calcium chloride. The 1954 yield in terms of 75 percent $CaCl_2$ equivalent, increased 5 percent, and the value increased 2 percent compared with 1953.

Cement.—California finished-portland-cement production increased 2 percent in 1954, compared with 1953, and shipments rose 2 percent in quantity while value increased 8 percent in the same period. The northern California mills produced 14,389,000 barrels of cement in 1954 (a decrease of 5 percent from 1953) and shipped 14,407,000 barrels valued at $43 million (a decrease of 5 percent in quantity

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and 2 percent in value compared with 1953), whereas the southern California mills produced 18,210,000 barrels (an increase of 7 percent over 1953) and shipped 18,355,000 barrels valued at $55 million (increasing 9 percent in quantity and 18 percent in value compared with 1953). The estimated surplus in local supply of portland cement based on apparent State consumption and shipments from mills in 1954 was 4.2 million barrels, compared with a surplus of 4.3 million barrels in 1953.

Of the 11 plants operated in 1954, 5 were in northern California (1 each in Calaveras County, Santa Clara County, San Benito County, San Mateo County, and Santa Cruz County) and 6 in southern California (3 in San Bernardino County and 1 each in Kern County, Riverside County, and Los Angeles County). The estimated annual finished-cement capacity in 1954 of northern California mills was 15 million barrels and southern California mills 20 million barrels. There was a decrease of 675,000 barrels at northern California mills and an increase of 300,000 barrels at southern California mills compared with 1953.

TABLE 22.—Finished portland cement produced, shipped, and in stock, and estimated consumption, 1945–49 (average) and 1950–54

Year	Active plants	Estimated capacity (thousand barrels)	Production (thousand barrels)	Shipments from mills			Estimated consumption (thousand barrels)	Stocks at mills Dec. 31 (thousand barrels)
				Thousand barrels	Value			
					Total	Average per barrel		
1945–49 (average)	11	28,352	21,220	21,261	$43,834,000	$2.06	17,789	942
1950	11	30,870	26,277	26,685	65,259,000	2.45	23,508	818
1951	11	32,620	29,918	28,956	77,754,000	2.69	25,192	1,776
1952	11	35,120	29,585	29,786	79,458,000	2.67	26,361	1,575
1953	11	35,220	32,145	32,002	90,873,000	2.84	27,737	1,708
1954	11	34,845	32,599	32,762	98,251,000	3.00	28,761	1,563

TABLE 23.—Production, shipments from mills, and stocks at mills of finished portland cement in 1954, by months, in thousand barrels

Month	Mill production	Mill shipments	Shipments to California[1]	Stocks at mills (end of month)
January	2,324	1,869	1,631	2,170
February	2,124	2,232	1,981	1,697
March	2,516	2,440	2,125	2,137
April	2,602	2,902	2,521	1,839
May	2,786	2,879	2,594	1,746
June	2,776	2,913	2,598	1,609
July	2,880	2,809	2,481	1,680
August	2,851	3,001	2,597	1,530
September	2,875	3,034	2,590	1,240
October	3,064	3,034	2,718	1,400
November	2,822	2,408	2,426	1,430
December	2,742	2,607	2,266	1,563

[1] Includes interstate and intrastate shipments.

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Clays.—Total California clays and shale production increased 12 percent in quantity and decreased 10 percent in value compared with 1953, while clay and shale produced for cement increased 1 percent in quantity and increased 2 percent in value. Of the total clay output in 1954 miscellaneous clay including shale comprised 2.3 million short tons valued at $2.9 million; fire clay, 381,400 short tons valued at $1.2 million; kaolin, 30,000 short tons valued at $288,600; and other clays (ball clay, bentonite and fuller's earth), 9,000 short tons valued at $120,000. By uses, producers of heavy clay products consumed 48 percent of the State's clay and shale output; cement, 33 percent; lightweight aggregate, 8 percent; firebrick and blocks, 5 percent; rotary drilling mud, 2 percent; architectural terra cotta, 1 percent; and miscellaneous products (including white wall, art pottery, high-grade tile, paint, refractories, filtering and decolorizing oils, fertilizer, filler, insecticide, and plaster), 3 percent. Principal producers of clay by types follow: Kaolin, Southern California Minerals Co., San Bernardino County; fire clay, Gladding, McBean & Co., Amador, Orange, Placer, and Riverside Counties; fuller's earth, Rock & Mason, Inyo County; and miscellaneous clays for other than cement, Gladding, McBean & Co., and Higgins Brick & Tile Co., Los Angeles County, and Basalt Rock Co., Solano County.

TABLE 24.—Clays (except for cement) produced by counties, and total clays produced, 1953–1954

County	1953		1954	
	Short tons	Value	Short tons	Value
Alameda	11,690	$12,590	28,763	$18,817
Amador	117,021	324,243	138,686	490,312
Calaveras	19,514	41,645	21,299	45,884
Contra Costa	64,806	92,265	63,405	77,902
Humboldt	450	450	486	122
Imperial			1,998	12,140
Inyo	2,747	98,819	6,087	31,631
Kern	68,324	599,704	46,266	433,994
Los Angeles	420,922	428,671	589,767	417,978
Mono	(1)	(1)	2,159	15,113
Orange	47,314	178,981	38,792	119,083
Placer	144,225	315,947	107,922	240,873
Riverside	225,934	1,063,611	240,313	773,852
Sacramento	19,493	33,043	19,068	24,322
San Benito	88	1,000	68	816
San Bernardino	41,930	353,850	49,530	300,279
San Diego	28,515	21,405	26,255	13,200
San Joaquin	22,699	19,640	(1)	(1)
Santa Clara	17,245	14,751	63,128	31,576
Stanislaus	4,928	18,657	3,135	11,556
Tulare	5,790	5,790	4,869	2,435
Ventura	80,808	88,227	57,590	105,577
Undistributed [1]	1,085,465	1,239,434	1,213,264	1,309,712
Total	2,429,888	4,952,723	2,722,850	4,477,174

[1] Includes clays used for cement and Fresno, Marin, Mono (1953), San Joaquin (1954), Santa Barbara, Solano, Sutter, and Yuba Counties combined to avoid disclosure of individual company operations.

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Diatomite.—The largest diatomite yield in California came from Santa Barbara County, where Johns-Manville Products Corp. and Great Lakes Carbon Corp. Dicalite Division worked deposits and operated processing plants in the Lompoc district. Los Angeles County was next in output from diatomite produced at the Great Lakes Carbon Corp. Dicalite Division Walteria quarry and plant. A minor yield was made in Napa County by the Basalt Rock Co., Inc., quarry and plant near Napa. The 1954 prepared sales 9 percent under 1953, owing to lesser demand, were used as follows: Filtration, 63 percent; insulation, 10 percent; fillers, 24 percent; and other uses, including pozzolan and miscellaneous admixtures, nearly 3 percent.

Johns-Manville Co. announced plans for constructing a new plant at Lompoc, Calif., utilizing diatomite for manufacturing synthetic silicates for use as inert absorbents, bulking agents, or extenders in paints and in rubber, paper, cleanser, insecticides, fertilizers, dry cleaning, and petroleum refining.

Feldspar.—The 1954 production of crude feldspar was obtained from ore from the Gladding, McBean & Co. Beck mine in San Bernardino County, the N. W. Sweetser Rosamond mine in Kern County, and a flotation product of the Del Monte Properties Co. Del Monte sand plant in Monterey County. The feldspar material was used principally by the glass and ceramic industries, although smaller quantities were used in refractory brick.

Fluorspar.—Some fluorspar was mined and stockpiled by the California Pacific Fluorite Corp. Pacific mine in San Bernardino County in the course of annual assessment work.

Garnet.—Some garnet was obtained from tailing at tungsten mills in Inyo County and sold as sand-blasting material.

Gem Stones.—Gem-stone production is difficult to determine, since fine-quality stones are scarce and small transactions that involve collectors are not recorded. Of gem stones reported in 1954, turquois found at the Independence mine in Inyo County provided the largest recorded yield. A small quantity of kunzite was found in the Pala district, San Diego County.

Gypsum.—Production of crude gypsum and gypsite decreased 3 percent in quantity and 2 percent in value compared with 1953, owing largely to less demand for gypsite (impure gypsum) by agriculturists. The largest contribution to the State total was from Imperial County, followed by: Kern, Riverside, Kings, San Luis Obispo, and Ventura Counties. The principal producer of gypsum was United States Gypsum Co., with quarries and plants in Imperial and Riverside Counties. H. M. Holloway, Inc., of Kern and Kings

TABLE 25.—Crude gypsum mined, 1945–49 (average) and 1950–54

Year	Active mines	Short tons	Value	Year	Active mines	Short tons	Value
1945–49 (average)	10	711,416	$1,697,241	1952	13	1,236,430	$2,721,134
1950	11	962,373	2,462,604	1953	16	1,199,489	2,855,983
1951	10	1,092,885	2,602,750	1954	15	1,161,502	2,803,862

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Counties was the principal producer of gypsite. The production of byproduct gypsum from the chemical plant of Westvaco Mineral Products Division in Alameda County was not included in the State total crude gypsum. The use of gypsum in plaster and wallboard and as a cement retarder supplied a large percentage of the consumption.

Iodine.—Deepwater Chemical Co., Ltd., and Dow Chemical Co. supplied California crude-iodine production in 1954—the total output of the commodity in the United States. The iodine was recovered from the waste brines of oil wells in the Los Angeles Basin (Orange and Los Angeles Counties). The 1954 production dropped 4 percent, and value declined 12 percent, compared with 1953.

Lime.—California total lime production decreased 30 percent in quantity and 27 percent in value compared with 1953 owing to lesser demand partly attributable to the 90-day steel-plant strike. Chemical and industrial uses dropped 36 percent, 56 percent of the State output. In order of consumption, refractory use decreased 20 percent and building use declined 19 percent. However agriculture, the smallest consumer, increased 30 percent. In 1954 the total lime produced amounted to 212,000 short tons, of which 85 percent was in the form of quicklime and 15 percent hydrated lime. Limekilns were operated in El Dorado, Monterey, San Bernardino, and Tuolumne Counties.

Lithium Minerals.—American Potash & Chemical Corp. produced crude sodium-lithium phosphate as a byproduct of its dry-lake brine operation at Searles Lake, San Bernardino County.

Magnesite.—A small tonnage of magnesite was mined in the Red Mountain district, Santa Clara County, during 1954. The entire output was consumed within the State at magnesium-salts plants.

Magnesium Salts.—Production of magnesium salts from all types of treated raw materials decreased substantially from the 1953 output. Westvaco Mineral Products Division (Alameda and San Diego Counties), Kaiser Aluminum & Chemical Corp. (Monterey County), Philadelphia Quartz Co. of California and Pabco Products, Inc. (Alameda County), and Marine Magnesium Products Division (San Mateo County), were producers of magnesium compounds in 1954. Raw sea water, sea-water bitterns, and dolomite from San Benito and Monterey Counties and magnesite from Santa Clara County were the basic materials consumed. The estimated yield of magnesium salts from sea water and bitterns, in terms of MgO equivalent, decreased 27 percent in quantity and 22 percent in value, compared with 1953.

Marl.—Marlife Co. quarried a caliche-type marl in Fresno County. The material was used for soil improvement.

Mica.—Some mica schist was quarried in Imperial County. The material was ground, screened, and sold as composition-roofing powder. It was classified as flake mica, but no clean separation of the mica was made. Some mica of foreign origin was ground in Los Angeles County.

Perlite.—California crude perlite sold or used by producers decreased 3 percent in quantity and 9 percent in value from 1953.

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This yield fell short of the requirements of State plants that expanded the crude material. In 1954 a total of 25,000 short tons of expanded perlite valued at $1,079,800, produced at California plants, was sold or used, compared with 35,300 short tons valued at $1,602,000 in 1953. Crude perlite was quarried in Inyo, Napa, San Bernardino Counties. The leading producer was the California Perlite Corp. in San Bernardino County. Perlite-expanding plants were operated in Fresno, Los Angeles, Marin, Napa, San Bernardino, San Diego, and San Mateo Counties. Principal uses of expanded perlite were: Plaster aggregate, oil-well-drilling mud, filter aid, insulation, and concrete aggregate.

Potassium Salts.—American Potash & Chemical Corp. treated brines at its Searles Lake plant in San Bernardino County and was the principal producer of potassium salts in California in 1954. An accumulation of low-grade potash material, recovered as a byproduct of cement manufacture in Contra Costa and Santa Cruz Counties, was used for soil enrichment.

Pumice and Pumicite.—California pumice output, exclusive of volcanic cinder, decreased 12 percent from 1953. This decline, continuing from 1951, reflected the consistent competition between expanded perlite and bloated shales in lightweight aggregates and with ground silica sand in scouring compounds. Siskiyou County was the principal source of sawed pumice blocks used as an abrasive. Other uses for pumice included: Insulation, pesticide diluent, filler, and absorbent.

TABLE 26.—Pumice and pumicite [1] sold, or used by producers in 1954, by counties

County	Crude		Prepared		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Fresno			5,865	$103,691	5,865	$103,691
Imperial			5,293	25,000	5,293	25,000
Inyo			62,459	165,471	62,459	165,471
Lassen	185	$312	1,261	2,982	1,446	3,294
Modoc	35,466	8,019	3,186	10,425	38,652	18,444
Mono	4,114	36,197	7,320	45,357	11,434	81,554
Siskiyou	406,000	168,291	18,574	17,452	424,582	185,743
Other counties [2]	996	1,970	15,937	66,471	16,933	68,441
Total	446,769	214,789	119,895	436,849	566,664	651,638

[1] Includes volcanic cinder.
[2] Amador, Calaveras, Kern, Lake, Madera, San Bernardino, and Shasta Counties.

TABLE 27.—Pumice and pumicite [1] sold or used in 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	136,054	$834,712	1952	129,780	$793,716
1950	157,497	970,826	1953	433,105	647,910
1951	264,411	1,288,569	1954	566,664	651,638

[1] Includes volcanic cinder.

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Pyrite.—The Mountain Copper Co., Ltd., produced pyrite in 1954 from the Hornet mine, Shasta County. The ore was shipped principally to Contra Costa County sulfuric acid plants. Some of the pyrite-cinder residue from these plants was utilized as the iron oxide in portland cement.

Salt (Sodium Chloride).—California's principal salt production was from the salt beds on the shores of San Francisco Bay. Alameda County led in output of salt, contributing 897,000 short tons valued at $5.1 million. Other counties that produced salt, in descending order, were: San Bernardino, San Diego, Monterey, Orange, and Kern. Leslie Salt Co. (Alameda County), and California Salt Co. (San Bernardino County) were the leading producers. Solar evaporation was the main method of recovering salt from sea water, although the vacuum-pan method of evaporation was also used. The State's 1954 yield rose 6 percent in quantity but dropped 2 percent in value from 1953, as harvests in the San Francisco Bay region salt ponds returned to near normal. Salt sold or used by California producers comprised 991,000 short tons of evaporated salt valued at $5.5 million and 194,700 short tons of rock salt valued at $595,000.

TABLE 28.—Salt sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Percent of United States total	Value	Year	Short tons	Percent of United States total	Value
1945–49 (average)	814,188	5	$3,726,332	1952	1,148,693	6	$4,880,392
1950	858,496	5	3,816,655	1953	1,123,365	5	6,263,059
1951	1,275,574	6	5,261,780	1954	1,185,844	6	6,126,194

Sand and Gravel.—Total production of sand and gravel from commercial and Government-and-contractor operations increased 21 percent in quantity and 28 percent in value compared with 1953. The higher figure for sand and gravel can be attributed in a small degree to the better coverage of the contractor-consumer segment of the construction industry, which the Bureau of the Census-Bureau of Mines canvass afforded. The building trades, road construction, and dam projects consumed a large percentage of this material, although industrial sands were an important production item in the State. All 58 counties in California, except San Francisco County, contributed to the State sand and gravel output in 1954. Los Angeles County alone furnished 36 percent of the State total sand and gravel yield. Other counties with noteworthy production were: Alameda, Orange, San Bernardino, Sacramento, San Diego, San Joaquin, Ventura, Sonoma, Fresno, Yolo, and Monterey.

Government-and-contractor operations included the California Division of Highways, various county and city road departments, and the following Federal agencies: United States Department of the Interior, Bureau of Indian Affairs and Bureau of Reclamation; United States Department of Agriculture, Forest Service; United States Department of Commerce, Bureau of Public Roads; United States Army Corps of Engineers; and the United States Navy.

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TABLE 29.—Sand and gravel sold or used by producers, 1945–49 (average) and 1950–54

Year	Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	13,053,622	$10,199,232	17,001,170	$13,741,483	30,054,792	$23,940,715
1950	17,812,379	15,136,857	24,081,660	20,410,701	41,894,039	35,547,558
1951	19,009,895	16,640,752	27,917,557	24,639,083	46,927,452	41,279,835
1952	20,434,017	18,060,627	32,617,243	25,572,498	53,051,260	43,633,125
1953	22,129,931	21,232,885	36,299,597	31,991,318	58,429,528	53,224,203
1954	25,094,671	25,655,359	45,429,941	42,483,219	70,524,612	68,138,578

TABLE 30.—Sand and gravel sold or used by producers, 1953–54, by commercial and Government-and-contractor operations and by uses

	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Glass				(1)	(1)	(1)
Molding	33,700	$84,686	$2.51	63,666	$285,123	$4.48
Building	12,676,258	11,362,921	.90	15,092,777	15,114,218	1.00
Paving	6,383,638	5,578,210	.87	5,327,995	4,711,404	.88
Blast	126,945	400,888	3.16	141,693	654,513	4.62
Engine	84,407	92,385	1.09	66,006	98,548	1.49
Filter	(1)	(1)	(1)	(1)	(1)	(1)
Other [1]	842,196	2,742,163	3.26	607,034	2,440,584	4.02
Total commercial sand	20,147,144	20,261,253	1.01	21,299,171	23,304,390	1.09
Gravel:						
Building	13,255,772	13,698,631	1.03	16,673,759	18,217,166	1.09
Paving	9,328,175	9,501,357	1.02	12,036,903	12,937,697	1.07
Railroad ballast	268,768	194,877	.73	426,344	374,604	.88
Other	849,831	946,303	1.11	354,746	406,704	1.15
Total commercial gravel	23,702,546	24,341,168	1.03	29,491,752	31,936,171	1.08
Total commercial sand and gravel	43,849,690	44,602,421	1.02	50,790,923	55,240,561	1.09
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building	326,775	225,379	.69	215,532	180,206	.84
Paving	1,656,012	746,253	.45	3,579,968	2,170,763	.61
Total Government-and-contractor sand	1,982,787	971,632	.49	3,795,500	2,350,969	.62
Gravel:						
Building	5,452,315	3,105,707	.57	2,497,925	2,269,338	.91
Paving	7,144,736	4,544,443	.64	13,440,264	8,277,710	.62
Total Government-and-contractor gravel	12,597,051	7,650,150	.61	15,938,189	10,547,048	.66
Total Government-and-contractor sand and gravel	14,579,838	8,621,782	.59	19,733,689	12,898,017	.65
COMMERCIAL AND GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand	22,129,931	21,232,885	.96	25,094,671	25,655,359	1.02
Gravel	36,299,597	31,991,318	.88	45,429,941	42,483,219	.94
Grand total	58,429,528	53,224,203	.91	70,524,612	68,138,578	.97

[1] Included with "Other" to avoid disclosure of individual company operations.

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TABLE 31.—Production of sand and gravel, commercial and Government-and-contractor, in 1954, by counties

County	Commercial and Government-and-contractor, short tons	Total value	County	Commercial and Government-and-contractor, short tons	Total value
Alameda	4,165,508	$4,504,811	Nevada	90,416	$117,816
Alpine	36,820	27,890	Orange	3,681,772	3,424,748
Amador	39,296	17,244	Placer	130,114	106,082
Butte	849,182	1,030,391	Plumas	114,933	93,604
Calaveras	41,441	60,796	Riverside	828,918	1,302,672
Colusa	177,665	86,381	Sacramento	5,224,901	4,979,181
Contra Costa	516,912	507,978	San Bernardino	4,278,413	3,666,511
Del Norte	730,315	393,248	San Diego	4,079,436	4,719,018
El Dorado	84,727	69,756	San Joaquin	1,709,372	1,650,806
Fresno	1,245,458	1,213,555	San Luis Obispo	631,903	386,996
Glenn	485,929	289,594	Santa Barbara	837,923	667,188
Humboldt	597,314	604,954	Santa Clara	557,984	525,119
Imperial	922,857	749,286	Santa Cruz	763,318	726,470
Inyo	92,454	65,419	Shasta	639,622	582,836
Kern	659,508	797,214	Sierra	42,026	95,655
Kings	188,055	124,782	Siskiyou	181,903	168,693
Lake	181,353	130,869	Solano	79,612	67,059
Lassen	106,020	95,008	Sonoma	1,477,177	1,426,437
Los Angeles	25,359,979	23,010,654	Stanislaus	487,433	594,631
Madera	218,781	150,260	Tehama	358,804	324,895
Marin	60,000	84,000	Ventura	1,529,034	1,493,769
Mariposa	81,996	86,167	Yolo	1,124,153	932,615
Mendocino	525,645	630,348	Yuba	200,299	213,108
Merced	1,247,551	856,870	Other counties [1]	1,287,746	1,280,068
Modoc	447,324	310,682			
Monterey	1,105,551	2,671,736	Total	70,524,612	68,138,578
Napa	19,759	22,708			

[1] Includes Mono, San Benito, San Mateo, Sutter, Trinity, Tulare, and Tuolumne Counties, combined to avoid disclosure of individual company operations.

Slate.—The sole output of slate in California during 1954 was the relatively small production from El Dorado County. Most of the material was crushed and ground and used for filler and roofing granules; a small tonnage of the slate was used as flagging. The Pacific Minerals Co., Ltd., and the Kelsey Slate Co. were the producers, and the 1954 output decreased 13 percent in quantity and 11 percent in value from 1953.

Sodium Compounds.—Natural sodium carbonate was produced from dry-lake brines by American Potash & Chemical Corp. near Trona (soda ash) and West End Chemical Co. at Westend (soda ash), both in San Bernardino County, and by Columbia-Southern Chemical Corp. near Bartlett, Inyo County (soda ash and trona). American Potash & Chemical Corp. also produced natural sodium sulfate as salt cake near Trona, San Bernardino County.

Stone.—Production of stone including all types, showed a marked increase over 1953, because limestone used for cement and lime was added to the State total. Omitting the limestone thus used, the total stone production decreased 5 percent in quantity and increased 10 percent in value, compared with 1953. A high percentage of the stone used was crushed or broken, but there were outputs of dimensional granite in Fresno, Humboldt, Los Angeles, Madera, Placer, Riverside, San Bernardino, Santa Cruz, and San Diego Counties and rhyolite tuff in El Dorado County. Crushed marble from Tuolumne County was in demand for terrazzo. Volcanic cinder output was included with pumice and pumicite in 1954, whereas this commodity was included with miscellaneous stone before 1953.

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Government-and-contractor operations included the California Division of Highways, Imperial Irrigation District, various county road departments and the United States Department of the Interior, Bureau of Reclamation.

TABLE 32.—Stone, commercial and Government-and-contractor, sold or used, 1953–54, by uses

Use	1953		1954	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction and rubble...short tons	11,431	$44,645	14,412	$102,544
Rough architectural...cubic feet	9,492	92,808	62,901	203,818
Approximate equivalent in short tons	776		5,064	
Monuments and mausoleums...cubic feet	29,571	148,823	22,804	75,028
Approximate equivalent in short tons	2,400		1,869	
Flagging...cubic feet	3,133	4,617	1,938	4,242
Approximate equivalent in short tons	246		155	
Total dimension stone (quantities approximate, in short tons)	14,853	290,893	21,500	385,632
Crushed and broken stone:				
Riprap...short tons	872,172	1,539,269	1,603,001	3,301,717
Metallurgical...do	63,021	185,092	100,097	320,223
Concrete and road metal...do	10,434,506	10,771,937	10,272,626	11,577,095
Railroad ballast...do	704,729	697,948	307,207	345,936
Agricultural...do	1,095	3,488	545	3,700
Chemical...do	614,076	1,896,794	14,640	90,468
Miscellaneous [1]...do	[2] 1,792,896	[2] 3,087,231	[2] 10,984,140	[2] 21,516,343
Total crushed and broken stone...do	[2] 14,482,495	[2] 18,181,759	23,282,256	37,155,482
Grand total (quantities approximate, in short tons)	[2] 14,497,348	[2] 18,472,652	23,303,756	37,541,114

[1] Includes whiting substitute, filler, mineral food, poultry grit, stucco, roofing granules, filter beds, terrazzo, and miscellaneous uses.
[2] Revised.
[3] Revised; includes 9,150,155 short tons of limestone used in cement valued at $16,017,315 and 417,036 tons of limestone used in lime valued at $1,212,232.

TABLE 33.—Production of stone,[1] commercial and Government-and-contractor in 1954, by counties

County	Short tons	Value	County	Short tons	Value
Alameda	1,230,163	$939,021	Orange	25,326	$51,080
Amador	7,374	15,858	Placer	5,243	66,188
Butte	57,669	23,495	Plumas	3,295	5,681
Calaveras	680,205	1,043,318	Riverside	1,152,691	2,038,911
Contra Costa	851,581	1,195,252	San Benito	926,564	1,192,598
Del Norte	146,509	620,561	San Bernardino	3,816,698	7,082,300
El Dorado	296,533	893,380	San Diego	398,526	743,987
Fresno	504,408	510,492	San Luis Obispo	61,050	247,147
Humboldt	38,941	90,845	San Mateo	1,824,199	1,283,994
Imperial	19,643	7,555	Santa Barbara	18,600	123,600
Kern	929,922	3,364,042	Santa Clara	3,085,413	4,391,194
Kings	15,694	32,199	Santa Cruz	514,863	1,301,997
Lake	12,300	6,150	Shasta	69,147	86,613
Lassen	69,392	96,770	Sierra	1,950	1,543
Los Angeles	3,795,444	4,616,995	Trinity	35,593	35,485
Madera	23,714	52,027	Ventura	501,054	890,256
Mendocino	14,100	28,200	Undistributed	2,208	3,529
Modoc	72,633	108,646	Other counties [2]	1,292,016	2,377,586
Monterey	319,105	1,007,291			
Napa	483,990	965,328	Total	23,303,756	37,541,114

[1] Includes stone used in cement and lime.
[2] Includes Marin, Nevada, Siskiyou, Solano, Sonoma, Tulare, and Tuolumne, combined to avoid disclosure of individual company operations.

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TABLE 34.—Stone sold or used by producers, commercial and Government-and-contractor, 1950–54, by kinds

Year	Granite		Basalt and related rocks (traprock)		Marble	
	Short tons	Value	Short tons	Value	Short tons	Value
1950	1,834,060	$1,690,722	1,293,030	$1,371,622	4,410	$80,212
1951	1,910,307	2,088,967	1,652,314	1,921,527	8,435	171,083
1952	1,903,866	1,979,756	1,996,536	2,524,972	7,168	137,664
1953	3,565,847	3,214,767	2,664,009	2,800,346	(1)	(1)
1954	3,012,041	3,480,586	2,129,545	2,786,035	(1)	(1)

Year	Limestone		Sandstone		Other stone [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1950	1,061,040	$2,819,555	1,698,020	$1,777,982	5,874,070	$6,258,339	11,764,630	$13,998,432
1951	1,158,999	3,443,408	1,508,495	1,549,001	6,298,794	5,540,538	12,537,344	14,714,524
1952	1,631,369	4,033,203	1,029,084	1,290,141	7,806,607	7,731,349	14,374,930	17,697,065
1953	1,991,949	4,930,005	2,093,219	2,835,693	4,199,156	4,698,341	14,514,180	18,479,152
1954	[3] 11,044,061	[3] 21,434,189	2,703,599	3,723,255	4,414,510	6,117,049	23,303,756	37,541,114

[1] Figure withheld to avoid disclosure of individual company operations.
[2] Includes light colored volcanics, schist, serpentine, river boulders, and such other stone as cannot properly be classed in any main group, and marble (1954).
[3] Includes 9,567,191 tons of limestone valued at $17,229,547 used in cement and lime.

Strontium Minerals.—Pan Chemical Co. produced a small tonnage of celestite in San Diego County.

Sulfur.—Sulfur-ore output for 1954 was the highest attained in the State, surpassing the former peak in 1953. The California production was solely from the Anaconda Copper Mining Co. Leviathan open-pit mine in Alpine County. The ore, which was shipped to Yerington, Nev., contained 30 percent sulfur and was used for sulfuric acid manufacture. Brimstone recovered as a byproduct in the liquid purification of gas by oil companies in Los Angeles County and hydrogen sulfide obtained at oil refineries in the refining process in Los Angeles and Contra Costa Counties contained a total of 93,908 long tons of sulfur. The American Smelting & Refining Co. recovered liquid sulfur dioxide as a byproduct of smelting sulfides ores at Selby, Contra Costa County. Sulfur paste and sludge from spent acid was shipped to chemical plants from oil refineries in Contra Costa County.

Talc, Pyrophyllite, and Soapstone.—Production of crude talc, pyrophyllite, and soapstone increased 6 percent in quantity and 7 percent in value over 1953. Of the total crude material mined in 1954 in California, 55,600 tons valued at $642,500 was produced in San Bernardino County (talc and pyrophyllite), 48,500 tons valued at $484,100 in Inyo County (talc), and the remaining 29,400 tons valued at $84,600 in San Diego County (pyrophyllite), El Dorado County (soapstone), Mono County (pyrophyllite), Los Angeles County (soapstone), and Riverside County (pyrophyllite). Grinding mills were operated in Alameda County (talc and soapstone), Inyo County (talc, pyrophyllite, and soapstone), Los Angeles County (talc, pyrophyllite, and soapstone), San Diego County (pyrophyllite), and San Francisco County (talc and soapstone). Ground talc was used principally in ceramics, paint, rubber, toilet preparations, and

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battery cases with smaller quantities for paper, insecticides, rice polishing, textiles, and plastics. Pyrophyllite was used largely in insecticides, paper, and stucco and soapstone in insecticides and asphalt filler.

Vermiculite.—Although no vermiculite was produced in California, exfoliating plants were operated by California Zonolite Co. in Los Angeles and Sacramento, principally on Montana crude material. The expanded vermiculite was used chiefly in construction and chemical fields and for industrial insulation.

Volcanic Cinder.—Volcanic cinder, tabulated with pumicite, was produced largely in Siskiyou County, where the yield was 398,600 tons valued at $108,000. Output also was reported in Inyo, Lake, Lassen, Modoc, San Bernardino, and Shasta Counties. The principal uses for this material were railroad ballast, concrete aggregate, and road surfacing. The Southern Pacific Railroad Co. in Siskiyou County, the Great Northern Railway Co. in Modoc County, and the Redlite Aggregate, Ltd., in Inyo County were California's largest producers in 1954.

MINERAL FUELS

Carbon Dioxide (Natural).—Carbon dioxide gas, used largely for "dry ice," was withdrawn from Salton Sea field, Imperial County, and the Hopland field, Mendocino County. Production of this gas was 30 percent less than in 1953, due to the closing of wells in the Salton Sea field after 6 months operation in 1954.

Coal.—Approximately 3,000 tons of lignite was mined in Amador County near Ione as a raw material in preparing extracted products, principally montan wax.

Natural-Gas Liquids.—In 1954 the yield of natural gasoline and cycle products from natural gas treated at California plants in 8 counties increased 1 percent in quantity and 4 percent in value. The output of liquefied petroleum products from the same source decreased slightly in quantity and increased slightly in value over the previous year.

Peat.—Peat, dug in Orange, Modoc, and Contra Costa Counties, was utilized by agriculturists for soil improvement.

Petroleum and Natural Gas.—Crude-petroleum production in California during 1954 decreased 25,000 barrels per day from 1953. Average production in 1954 was 957,000 barrels per day, representing the third highest year in history. The downward trend in production was due to the inability of new drilling to entirely offset natural decline of resources during the year.

Average production of dry natural gas in California was 330 million cubic feet per day compared with 367 million cubic feet per day in 1953 and 386 million cubic feet in 1952. Dry gas was produced from 66 dry-gas fields from 416 producing wells in 1954, compared with 391 producing wells at the end of 1953. During 1954, 34 new gas wells were completed in dry-gas fields, 22 more than in 1953. The Beehive Bend, River Island, and Trico fields showed the most active development.

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TABLE 35.—Natural gas, natural-gas liquids, and petroleum produced, by counties, in 1954 [1]

County	Marketed natural gas		Natural-gas liquids				Petroleum	
			Natural gasoline and cycle products		LP-gases			
	Million cubic feet	Value (thousand dollars)	Thousand gallons	Value (thousand dollars)	Thousand gallons	Value (thousand dollars)	Thousand 42-gallon barrels	Value (thousand dollars)
Alameda	9	(2)						
Butte	4,902	1,010						
Colusa	4	(2)						
Contra Costa	770	(2)						
Fresno	34,854	7,180	63,992	6,190	59,245	3,329	34,643	98,556
Glenn	747	154						
Humboldt	1,915	(2)					(2)	(2)
Kern	97,399	20,064	239,821	23,197	130,126	7,312	91,110	225,152
Kings	26,724	5,505	(2)	(2)	(2)	(2)	2,774	8,788
Los Angeles	90,673	18,679	274,553	26,556	39,238	2,205	92,972	248,160
Madera	3,144	648						
Monterey	1,351	(2)					11,213	13,587
Orange	34,719	7,152	138,090	13,357	46,977	2,640	37,824	93,363
Sacramento	52,676	10,851						
San Benito	24	(2)					22	(2)
San Bernardino							21	(2)
San Joaquin	5,782	1,191						
San Luis Obispo	1,054	(2)	(2)	(2)	(2)	(2)	3,185	9,488
Santa Barbara	17,626	3,631	41,563	4,020	18,492	1,039	33,342	77,492
Santa Clara							2	(2)
Solano	30,490	6,281						
Sonoma							(2)	(2)
Sutter	950	(2)						
Tehama	527	109						
Tulare	5,655	1,165					43	(2)
Ventura	92,622	19,080	131,109	12,682	56,791	3,191	48,714	132,678
Yolo	2,672	550						
Undistributed		1,252	34,032	3,291	45,317	2,546		196
Total	507,289	104,502	923,160	89,293	396,186	22,262	355,865	907,460

[1] Production from those petroleum and natural-gas fields which lie in more than one county was prorated among the involved counties.
[2] Included with "Undistributed."
[3] Less than 500 barrels.

SECONDARY METALS

Iron and Steel Scrap.—Ferrous scrap consumption at California steel and iron furnaces dropped 15 percent from 1953 owing to decreased use at steel furnaces. Consumption increased at iron furnaces and declined slightly for miscellaneous operations.

Nonferrous Metals Scrap.—Secondary lead, zinc, brass, white metals, type metals, antimonial lead, and other alloys, produced chiefly in the San Francisco and Los Angeles areas, were offered in competition with primary metals on the markets.

In 1954 California foundries reported consumption of 16,990 short tons of brass and bronze ingot made chiefly from copper-base scrap. This is compared with 19,200 tons consumed in 1953 and 16,200 tons in 1952. Leaded red-brass ingot, the largest single item used, amounted to 12,624 tons in 1954, 13,300 tons in 1953, and 11,500 tons in 1952.

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TABLE 36.—Consumption of ferrous scrap and pig iron, 1945–49 (average) and 1950–54

Year	Total scrap used (short tons)	Pig iron used (short tons)	Year	Total scrap used (short tons)	Pig iron used (short tons)
1945–49 (average)	1,771,956	586,167	1952	2,470,169	1,288,561
1950	2,217,674	937,740	1953	2,574,840	1,233,898
1951	2,638,565	1,271,574	1954	2,185,451	1,000,576

TABLE 37.—Consumption of ferrous scrap and pig iron, 1953–54, by types of furnaces and miscellaneous uses, in short tons

Ferrous scrap and pig iron charged to—	1953	1954	Ferrous scrap and pig iron charged to—	1953	1954
Steel furnaces:[1]			Miscellaneous uses:[3]		
Scrap	2,182,341	1,764,068	Scrap	48,284	48,215
Pig iron	1,072,992	845,976	Total scrap	2,574,840	2,185,451
Total	3,255,333	2,610,044	Total pig iron	1,233,898	1,000,576
Iron furnaces:[2]			Grand total	3,808,738	3,186,027
Scrap	344,215	373,168			
Pig iron	160,906	154,600			
Total	505,121	527,768			

[1] Includes open-hearth and electric furnaces.
[2] Includes cupola, air, and blast furnaces, also direct castings.
[3] Includes rerolling, copper precipitation, nonferrous and chemical uses.

REVIEW BY COUNTIES AND DISTRICTS

Alameda.—In Alameda County, the processing and consumption of minerals was more important than their production. Palo Alto Mining Corp. shipped 2,782 long tons of chromite ore from the Mendenhall, Newman, and Saco open-pit operation in the Cedar Mountain area to the company concentrating plant in Santa Clara County. The concentrate produced was shipped to the Grants Pass, Oreg., Government Purchase Depot.

In the Oakland-Berkeley area barite from Nevada and Arizona was crushed and ground by Yuba Milling Co. at Emeryville, Chemical & Pigment Co. at Oakland, and Industrial Minerals & Chemical Co. at its Berkeley custom mill. The latter company also ground, on a custom basis, the following minerals, all produced outside the county: Soapstone, limestone, clay, talc, magnesite. chromite, scoria, feldspar, bentonite, quartz, and fluorspar. The San Leandro Rock Co. at San Leandro produced sandstone and quartzite, and Gallagher & Burk, Inc., produced crushed basalt at Oakland for riprap, concrete, and other uses. At Emeryville C. K. Williams & Co. processed iron oxide pigments, Pabco Products, Inc., operated an asphalt plant rated at 2,500 barrels daily crude-oil throughput capacity; and Judson Steel Corp. operated open-hearth furnaces, principally on steel scrap, and rolling mills. Nonmetallic minerals, including California magnesite, were processed by Philadelphia Quartz Co. at Berkeley.

In the Livermore area sand and gravel was prepared by the California Rock & Gravel Co. at Livermore; and Henry J. Kaiser Co., Pacific Coast Aggregates, Inc., and A. C. Zaro, at Pleasanton. Natural gas was produced in the Hospital Nose field during the second half of 1954.

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TABLE 38.—Mineral production in California in 1954, by counties [1]

County	Value	Minerals produced in 1954 in order of value
Alameda	$12,047,155	Salt, sand and gravel, magnesium compounds, stone, bromine, chromite, clays, natural gas.
Alpine	(2)	Sulfur, tungsten, sand and gravel.
Amador	622,007	Clays, copper, coal, gold, sand and gravel, stone, silver, tungsten, lead, pumice.
Butte	2,175,791	Sand and gravel, natural gas, chromite, stone, gold, silver.
Calaveras	8,455,643	Cement, stone, clays, sand and gravel, gold, tungsten, pumice, silver.
Colusa	88,409	Sand and gravel, chromite, natural gas.
Contra Costa	2,706,926	Stone, sulfur (byproduct), sand and gravel, natural gas, clays, peat, potassium, mercury.
Del Norte	1,349,774	Stone, sand and gravel, chromite, mercury.
El Dorado	1,831,309	Stone, lime, gold, slate, sand and gravel, soapstone, chromite, copper, lead, zinc, silver, tungsten.
Fresno	117,662,874	Petroleum, natural-gas liquids, natural gas, sand and gravel, stone, tungsten, chromite, pumice, clays, marl, mercury, gold, silver.
Glenn	478,547	Sand and gravel, natural gas, chromite.
Humboldt	1,098,383	Sand and gravel, natural gas, stone, chromite, petroleum, clays.
Imperial [3]	2,360,545	Gypsum, sand and gravel, manganese and manganiferous ores, mica (scrap), tungsten concentrate, pumice, clays, stone, carbon dioxide, gold, strontium ore, silver.
Inyo [3]	10,532,917	Tungsten concentrate, lead, sodium carbonate, talc, zinc, silver, molybdenum, volcanic cinder, boron minerals, pumice, copper, sand and gravel, garnet, perlite, clays, gold, manganiferous ore.
Kern [3]	306,426,404	Petroleum, natural-gas liquids, natural gas, boron minerals, cement, stone, sand and gravel, clays, gypsum, tungsten concentrate, gold, salt, pumice, silver, feldspar, manganiferous ore.
Kings	19,157,133	Petroleum, natural gas, natural-gas liquids, gypsum, sand and gravel, stone.
Lake	770,993	Mercury, sand and gravel, chromite, manganese ore, stone, pumice, volcanic cinder.
Lassen	195,197	Stone, sand and gravel, volcanic cinder, tungsten.
Los Angeles	329,254,165	Petroleum, natural-gas liquids, sand and gravel, natural gas, stone, sulfur (byproduct), cement, diatomite, iodine, clays, soapstone, gold, titanium, silver.
Madera	1,967,257	Tungsten concentrate, natural gas, sand and gravel, stone, copper, pumice, gold, silver, zinc.
Marin	1,277,141	Stone, sand and gravel, clays.
Mariposa [3]	102,096	Sand and gravel, gold, manganiferous ore, tungsten concentrate, silver, lead, zinc.
Mendocino [3]	680,772	Sand and gravel, stone, carbon dioxide, manganese ore, manganiferous ore.
Merced	860,097	Sand and gravel, gypsum, gold.
Modoc	445,772	Sand and gravel, stone, pumice, volcanic cinder, peat.
Mono	2,952,678	Tungsten concentrate, sand and gravel pumice, clays, pyrophyllite, gold, silver.
Monterey	19,837,988	Petroleum, sand and gravel, lime, stone, magnesium compounds, ground sand, natural gas, feldspar, salt.
Napa	1,073,640	Stone, chromite, sand and gravel, mercury, perlite, diatomite.
Nevada	2,134,510	Gold, sand and gravel, silver, stone, tungsten concentrate, copper.
Orange	120,666,626	Petroleum, natural gas, natural gas liquids, sand and gravel, iodine, clays, stone, salt, peat, zinc, silver, lead, gold, copper.
Placer	440,655	Clays, sand and gravel, stone, gold, chromite, asbestos, silver.
Plumas	111,095	Sand and gravel, gold, stone, chromite, copper, silver.
Riverside [3]	24,279,619	Iron ore, cement, stone, sand and gravel, clays, gypsum, manganese and manganiferous ores, tungsten concentrate, asbestos, gold, copper, lead, silver, pyrophyllite.
Sacramento	18,028,904	Natural gas, sand and gravel, gold, clays, platinum, silver.
San Benito [3]	4,824,058	Cement, mercury, stone, petroleum, sand and gravel, clays, natural gas, chromite, manganiferous ore.
San Bernardino [3]	67,134,487	Cement, boron minerals, stone, sodium carbonate, potassium, sand and gravel, sodium sulfate, tungsten concentrate, talc and pyrophyllite, rare earths, salt, calcium-magnesium chloride, clays, lithium, manganese and manganiferous ores, bromine, lime, perlite, petroleum, gold, copper, volcanic cinder, pumice, silver, lead, feldspar, zinc.
San Diego	6,036,225	Sand and gravel, stone, salt, magnesium compounds, tungsten concentrate, pyrophyllite, clays, ground sand, gold, silver.
San Joaquin [3]	2,897,105	Sand and gravel, natural gas, clays, manganese ore.

See footnotes at end of table.

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TABLE 38.—Mineral production in California in 1954, by counties[1]—Continued

County	Value	Minerals produced in 1954 in order of value
San Luis Obispo[3]	$12,744,989	Petroleum, natural-gas liquids, chromite, sand and gravel, stone, natural gas, gypsum, mercury, manganese.
San Mateo	7,741,122	Cement, stone, sand and gravel, magnesium compounds.
Santa Barbara	93,319,524	Petroleum, diatomite, natural-gas liquids, natural gas, sand and gravel, stone, clays, chromite.
Santa Clara	23,270,838	Cement, stone, sand and gravel, clays, magnesite, chromite, petroleum.
Santa Cruz	6,106,528	Cement, stone, sand and gravel, potassium.
Shasta	1,580,233	Pyrites, sand and gravel, stone, copper, gold, iron ore, chromite, volcanic cinder, silver.
Sierra	568,097	Gold, sand and gravel, silver, stone, zinc.
Siskiyou	1,354,579	Gold, chromite, sand and gravel, stone, volcanic cinder, pumice, silver, asbestos, lead.
Solano	6,711,341	Natural gas, clays, stone, sand and gravel.
Sonoma	2,528,448	Sand and gravel, mercury, stone, petroleum.
Stanislaus[3]	611,086	Sand and gravel, manganese ore, clays, mercury, gold.
Sutter	279,824	Natural gas, clays, sand and gravel.
Tehama	505,889	Sand and gravel, natural gas, chromite.
Trinity[3]	384,548	Gold, sand and gravel, stone, chromite, manganese ore, copper, silver.
Tulare	2,129,813	Natural gas, tungsten concentrate, sand and gravel, petroleum, stone, clays, barite.
Tuolumne	885,306	Lime, stone, tungsten concentrate, chromite, sand and gravel, gold, silver.
Ventura	170,169,296	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone, clays, gypsum.
Yolo	1,482,615	Sand and gravel, natural gas.
Yuba	2,611,997	Gold, sand and gravel, clays, platinum, silver.
Undistributed	1,675,892	Gem stones, stone.
Total	1,429,627,000	

[1] San Francisco County was not listed because no production was reported.
[3] Included with "Undistributed" to avoid disclosure of mine output.
[3] Excludes value of manganese and manganiferous ores sold and blended at Government low-grade stockpiles for future beneficiation.

Salt production was centered on the southeast side of San Francisco Bay. American Salt Co. and Oliver Bros. Salt Co., at Mount Eden, obtained salt from waters of San Francisco Bay by solar evaporation.

At Newark Leslie Salt Co. also produced salt from the bay by solar evaporation. This company and Morton Salt Co. processed crude salt in the same locality. The Westvaco Chemical Division, Food Machinery & Chemical Corp., produced bromine and bromine compounds, refractory magnesia, caustic calcined magnesia (with gypsum as a byproduct) from salt-works bitterns and dolomite at its Newark plant.

Miscellaneous clay was produced and used by the California Pottery Co. and Interlocking Rooftile Co. at Niles and M & S Tile Co. at Decoto. Bell Sand & Gravel Co. shipped miscellaneous clay from Irvington. Gallagher & Burk, Inc., crushed basalt at Niles. Sand and gravel was prepared by Bell Sand & Gravel Co. at Irvington, Concrete Service Co. at Sunol; Henry J. Kaiser Co. and Niles Sand & Gravel Co. at Niles, and Pacific Coast Aggregates, Inc., and Rhodes & Jamieson, Ltd., at Centerville. These materials were used principally for base rock and aggregate. Pacific State Steel Co. operated open-hearth furnaces and a rolling mill at Niles. Harbison-Walker Refractories manufactured silica brick at Warm Springs. Raw materials utilized were produced outside the State.

Alpine.—Sand and gravel was produced in Alpine County by contractors for the Alpine County Highway Department and the California Division of Highways for paving purposes.

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Hope Valley District.—C. B. Lovestedt mined 398 tons of tungsten ore from the Alpine mine and shipped it to a custom mill for treatment. William C. Morrison worked the Valpine mine and shipped tungsten ore to several treatment plants. A DMEA exploration contract was also initiated at the Valpine mine in 1954. D. B. Lemaire operated a portable gravity mill for treating tungsten ores on a custom basis.

Monitor (Mogul) District.—Anaconda Mining Co. produced sulfur ore which contained about 30 percent sulfur, from the Leviathan open-pit mine near Markleville. The material was for consumption in the sulfuric acid plant of the company Yearington, Nev., acid-leaching copper operations.

Amador.—The Amador County Road Department and the California Division of Highways produced sand and gravel for paving purposes.

Cosumnes River District.—C. J. Lorentz operated a 1¼-cubic-yard dragline excavator and a gasoline-powered Bodinson floating washing plant on the Lorentz claims, 7 miles northeast of Plymouth. Gold and silver were recovered from the gravel.

East Belt District.—Lagomarsino Bros. leased the Elephant (Union Flat) placer mine and hydraulicked 750 cubic yards of gravel; 3 ounces of gold was recovered. Garibaldi Bros. worked the Garibaldi placer mine, using a ¾-cubic-yard dragline excavator and trommel. Gold and silver were recovered from 3,000 cubic yards of stream gravel. Ray Blakeslee operated the Elkhorn mine and shipped concentrate and amalgam, containing gold and silver, recovered from the mine ore at a custom mill in Calaveras County. O. W. L. Mining Co. recovered gold and silver from ore amalgamated at the Red Hill-Peterson mine; concentrate containing gold and silver was shipped to a California smelter. A small tonnage of gold ore containing silver was shipped to a smelter from the Rising Sun mine.

Mokelumne River District.—Joseph C. Warren & Dudley Chambers worked gold-bearing gravel on the C. R. Brown property, using a power shovel and floating washing plant. K. & L. Mining Co. worked the Colorado drift mine and washed the gravel in a portable plant, recovering gold and silver. Glenn & J. G. Modrell produced gold and silver from gravel on the Brown property, operating a dragline dredge. H. H. Kreth crushed lava rock for roofing material.

Mother Lode District.—Charles E. Adair tested milling ore from the Italian mine and produced amalgam and concentrate containing gold and silver. Amador Silica Sand Co. produced some glass sand from mine tailings at Plymouth.

West Belt District.—Volo Mining Co. mined copper ore containing gold, silver, and lead from the Copper Hill mine 7 miles west of Plymouth. The ore was treated in the Volo mill in El Dorado County and the copper concentrate shipped to a Washington smelter. Gladding, McBean & Co., Pacific Clay Products Co., and Western Refractories Co. operated open pits for fire clay and miscellaneous clay. A new washing plant for separating white clay and glass sand was constructed as a joint operation of Gladding, McBean & Co. and Owens Illinois Glass Co. near Buena Vista. Calaveras Cement Co. utilized kaolin from a stockpile at the Kaolin & Fye open pit at Buena Vista for cement at its Calaveras County plant. Volcanic ash was quarried

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at the Howard lease by Gladding, McBean & Co. at Ione. American Lignite Products Co. operated a lignite strip mine near Ione and processed the coal at Buena Vista, extracting principally montan wax.

Butte.—The California Division of Highways and its contractors produced sand and gravel for paving purposes. Natural gas was produced in the Chico, Durham, and Wild Goose fields in 1954.

V. K. McNichols & Wm. Josephson shipped a small tonnage of chromite ore from the Majestic open pit in the Big Bar Mountain area to a custom mill for upgrading. The Royal Drift Mining Co. explored the Royal drift mine in the *Butte Creek district* and produced a small quantity of gold and silver. Using hand methods, gold and silver were recovered in the *Forbestown district* by T. W. Paulson, who operated the Arlington and U. S. placer mines and in the *Yankee Hill district* by Louis Shack and L. B. Scantlan who worked the Bloomer and Davis placer mines, respectively. In the Chico area, Butte Creek Rock Co. prepared sand and gravel for structural concrete and mortar.

Magalia District.—Golden Feather Mines & Milling Co. washed a small quantity of auriferous gravel from the Golden Feather drift mine and recovered gold and silver. Helmke, Thomas & Janssen, the fifth largest producer of chromite in the State, operated the Lambert (Magalia) underground mine and shipped ore to the company mill at Castella, Shasta County, for upgrading. A DMEA contract was negotiated late in 1954, but no exploration was done during the year.

Oroville District.—Morris Ravine Mining Co. worked the Morris Ravine drift-mine gravels and recovered gold and silver. Sand and gravel for structural concrete and mortar was prepared by Mathews Ready Mix, Inc., at Gridley. Marler Rock Co. at Oroville, and Pentz Gravel at Pentz produced structural gravel for concrete.

Calaveras.—*East Belt (Salt Spring) District.*—Calaveras Cement Co. quarried limestone and shale, raw materials for cement, at its No. 4 pit. Low-grade tungsten ore from the Garnet Hill mine dump was treated at the Church mill in El Dorado County. Moore Creek Mining Co., Ind., shipped tungsten ore to a custom mill from the Moore Creek mine. Jupiter Lumber Co. produced miscellaneous stone for concrete and road metal. Nielsen gravel plant prepared sand and gravel at Mokelumne Hill for structural and paving purposes. J. R. Schofield shipped gold ore containing silver to a California smelter from the A. V. G. (Golden Scherer) mine. New Champion Mining Co. amalgamated 15 tons of dump ore from the Centennial mine and recovered gold and silver. The operator also treated gold ore on a custom basis. Frank Jiuffre and C. F. Burdick explored the Four Sons mine in the early part of 1954 and recovered a small quantity of gold by amalgamating the ore. A. L. Kirst prospected and developed pay shoots in the Littlefield mine and produced gold and silver by amalgamation. Marquis Mining Co. shipped amalgam and concentrate, containing gold and silver, produced at a custom mill from the Marquis (Lucky Sun) mine ore.

Mother Lode District.—Calaveras Cement Co., the largest single industrial establishment in the county, operated its 3.2 million-barrel-a-year-capacity cement plant at Kentucky House. Schmauder Mining Co. worked the Altaville drift mine and washed 2,000 cubic yards of ancient river gravels. Gold and silver were recovered. K. & S. Co. worked stream gravel on Calaveras Cement Co. property, using

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a 1¼-cubic-yard power shovel, a dragline excavator, and a floating washing plant. Gold and silver were recovered. George A. Markwood produced gold from stream gravel on the Markwood Ranch by small-scale hand methods. Lucky Four Mining Co. worked the Pellaton drift mine the first half of 1954 and recovered gold and silver from 150 cubic yards of ancient river gravel. F. G. Garbarini made a test shipment of gold ore from the Apex mine to a smelter, and George and John Miller shipped cleanup material and old tailing containing gold and silver from the Carson Hill mine to a smelter. Gold and silver amalgam produced at the New Ford mine was shipped to a bullion buyer.

West Belt District.—Mountain Gold Dredging Co. produced gold and silver from the D. W. McCarty property river gravels, using a 2-cubic-yard Bodinson dragline excavator and floating washing plant. The New Penn Mines, Inc., drilling and pumping activities at its copper-zinc property under a DMEA exploration contract ceased in mid-January. The California Pottery Co. and the Pacific Clay Products Co. shipped fire clay and miscellaneous clay from their open pits near Valley Center. Tyrrell-Hannah produced miscellaneous stone (brown jasper) for roofing at Valley Springs. At Burson, the H. D. Warren pumice plant produced crude pumice and pumicite. The material was used for concrete aggregate at Linden, San Joaquin County.

Colusa.—At Colusa, the Cortina Rock Sand & Gravel Co. produced sand and gravel, using portable equipment. Natural gas was withdrawn from the Princeton field. L. L. and J. Silver, and R. Clark explored the Black Beauty claim in the Indian Creek area and shipped a small tonnage of chromite ore.

Contra Costa.—Petroleum refining in northern California was centered in Contra Costa County. Plants of Standard Oil Co. of California, Shell Oil Co., Tide Water Associated Oil Co., and Union Oil Co. of California had an aggregate daily crude-oil throughput capacity of 413,900 barrels at the end of the year, an increase of 16,100 barrels over January 1, 1954.

At its Avon refinery the Tide Water Associated Oil Co. produced petroleum-refinery products and recovered hydrogen sulfide as a byproduct of the liquid purification of gases. At Martinez, Shell Oil Co. operated a petroleum refinery, and Serra Bros. quarried and crushed sandstone for concrete, railroad ballast, and other uses. Port Costa Brick Works at Port Costa dug miscellaneous clay for brick manufacture. General Chemical Division, Allied Chemical & Dye Corp., manufactured sulfuric acid from Shasta County pyrite at Nichols, and Mountain Copper Co., Ltd., prepared copper salts at Mococo, largely from scrap copper.

Columbia-Geneva Steel Division, United States Steel Corp., operated one of the principal California steel plants at Pittsburg and produced rolled structural shapes and tinplate. At Antioch, the Marchio Silica Sand Co. produced molding sand, and Morris sand pit produced paving sand.

The Richmond-Selby area was another industrial center. Union Oil Co. of California and Standard Oil Co. of California operated petroleum refineries at Oleum and Richmond, respectively. The latter company recovered hydrogen sulfide as a byproduct of the liquid puri-

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fication of gases. American Smelting & Refining Co. operated the Selby lead smelter and gold-silver refinery and produced liquid sulfur-dioxide as a byproduct of smelting sulfide ores. Blake Bros. Co. produced crushed sandstone for riprap, concrete, railroad ballast, and other uses at Point Richmond. United Material & Richmond Brick Co., Ltd., quarried shale for brick manufacture. Stauffer Chemical Co. utilized Shasta County pyrite for manufacturing sulfuric acid at Stege.

In other parts of the county, Silver Sand Co. produced paving and other sands at Cowell, and near Orinda, Henry J. Kaiser Co. and Tunnel Rock Co. quarried basalt for riprap, concrete, and road metal. Vita-Peat, Inc., dredged for reed or sedge peat near Bethel Island, and natural gas was withdrawn from the Rio Vista field, which also lies in Solano and Sacramento Counties.

Mount Diablo District.—Jonas & Johnson explored the Mount Diablo mine for mercury under a DMEA contract during the early part of the year. Mount Diablo Rock & Sand crushed miscellaneous stone for concrete and road metal.

Del Norte.—The California Division of Highways produced crushed sandstone and gravel in this county for State highway projects. Marlin Tryon produced paving sand for roadwork at Fort Dick, and Simonson Logging Co. produced crushed basalt at Smith River for road material. Macco-Morrison-Knudson quarried greenstone near Crescent City for jetties.

D. P. Wilfounge shipped a small tonnage of chromite ore from the Dead Horse underground and open-pit mine in the Sanger area. Ashland Mining Co. treated low-grade chromite ore from the Poker Flats claim in the company mill at Ashland, Oreg., and shipped concentrate to the Grants Pass, Oreg., Government Purchase Depot. L. J. Conley & H. B. Graham and J. & W. Mining Co. operated the French Hill (Tyson) open-pit chromite mine and shipped appreciable tonnages of ore. Harold T. Funk operated the Old Doe underground chromite mine in the Rattlesnake Mountain area and shipped substantial tonnages of ore to the Grants Pass, Oreg., Government Purchase Depot. In Red Mountain area R. H. Ellison shipped chromite ore from the Pyramid mine. The property lies partly in Humboldt County. C. H. McClendon developed chromite ore on the Bar-Rick, Buckskin, and Fourth of July mines in the Clear Creek area by stripping. Some experimentation was also done on the reduction of chromite to chromium salts.

In the upper Diamond Creek area Robert T. Box & Wayne Aho shipped a small tonnage of chromite ore and concentrate from the Aho & Box claims. Richard Dixon made a small shipment of chromite ore from the Elk Camp claims.

Low Divide District.—Simonson Logging Co. shipped chromite ore from the Copper Creek and Potato Patch underground mines. I. D. Zimmerman worked the Midnite claim and shipped a small tonnage of chromite ore. The Tyson Mining Co. worked the Mountain View underground mine and shipped chromite ore.

Gordon Mountain District.—Pioneer Mining Co. shipped chromite concentrate produced from ore mined at the Broken Shovel (Coon Creek) claims. Everett Longenecker shipped a small quantity of chromite ore to a custom mill from the Goose Egg No. 3 claim. J. W.

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Graham conducted development and explored the Spring underground and open-pit mine and shipped chromite ore, both to the Grants Pass, Oreg., Government Purchase Depot and to a custom mill. Nealy Logging Co. shipped chromite ore from the Sunrise No. 1 underground mine. Zinc Saddle Mining Co. did some development and explored the Zinc Saddle open-pit chromite mine. A small shipment of chromite was made.

High Plateau District.—George Shicora operated the Eagles Nest open-pit mine and mill and shipped chromite concentrate. High Plateau Mines operated a sink-float plant on chromite ore mined from the High Plateau open-pit mine and shipped concentrate to the Grants Pass, Oreg., Government Purchase Depot. Ernest G. Tarbell shipped a small lot of chromite ore from the High Point, Skyline, and Blue Bird claims. James L. Perry shipped appreciable tonnages of chromite ore from the Judy group open-pit operation. Howard Martin & Harry Bienick shipped ore from the Wonder underground chromite mine.

Patrick Creek District.—George Alcorn & W. O. Burch shipped a small tonnage of chromite ore from the Black Queen claim and began to construct a concentration plant. Pete Janzen made a small shipment of chromite ore from the Chrome Hill No. 1 underground mine and the Wolverene open-pit mine. Ed Carlson and Tulare Bros. Mining Co. operated the Holiday (High Dome) underground and open pit chromite mine and shipped ore and concentrate to the Grants Pass, Oreg., Government Purchase Depot. Leland Simonson & Roy A. Brown produced cinnabar from the Simbro (Webb) mine and recovered a small quantity of mercury by retort.

El Dorado.—The El Dorado County Road Department and its contractors prepared sand and gravel for road construction in the county. J. T. White produced structural sand for concrete and mortar at Lake Tahoe.

East Belt District.—Hazel Creek Mining Corp. operated the Hazel Creek mine and recovered gold and silver by amalgamation at the company 30-ton mill. Flotation concentrate shipped to a smelter yielded substantial quantities of gold and silver and some copper, lead, and zinc. Ivan H. Campion developed and mined the Irish Slide drift mine. Gold and silver were recovered from the ancient river gravels. Sciaroni Bros. shipped a small tonnage of tungsten ore to a custom mill from the Grizzley Flats claim. Dimensional building stone was prepared from rhyolite tuff by the T. C. Nutt quarry, Ralph C. Young, and Sierra Placerite Corp.

Mother Lode District.—Calivada Development Co. produced copper ore containing gold and silver from the El Dorado Copper (Roosevelt) mine near Garden Valley, and Noonday Copper Mining Co. mined copper ore containing gold and silver from the Noonday mine near Placerville. Ore from both mines was trucked to a custom mill near Placerville for treatment. The recovered copper concentrate was shipped to a Washington smelter. The El Dorado Copper mine was formerly reported in the West Belt district. Michael Laguerre engaged in pocket mining on the Ferriere property and amalgamated ore containing gold and silver. French Creek Mining Co. developed and explored the French Creek mine and recovered some gold by amalgamation during a test milling run. R. L. Brooks recovered gold by

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amalgamating a small quantity of ore from the Hilltop pocket mine. A. C. Arling amalgamated mill tailings from the Sliger mine and recovered a small quantity of gold. L. W. Loomis washed tailings from the Ziess-Loomis placer claim by small-scale hand methods and recovered gold and silver. W. L. Fisk developed and explored the Fisk gold property. S. T. Hilberg developed the Riverview gold mine by driving a raise to intersect the ore body. The Diamond Springs Lime Corp. quarried limestone and prepared quicklime and hydrated lime at the Diamond Spring plant for building, agricultural, chemical, and industrial uses. The El Dorado Limestone Co. at Shingle Springs prepared crushed limestone for concrete, flux, agriculture, and other uses. Sand for the manufacture of glass and structural gravel for concrete were produced by the El Dorado Rock & Sand Co. at Placerville. The Kelsey Slate Co. prepared slate for flagging at Kelsey. At Chili Bar, Pacific Minerals Co., Ltd., prepared crushed and ground slate for roofing granules and flour. L. Boettcher prospected for and recovered scheelite-bearing boulders in Slab Creek; a small quantity of the material was shipped. Tungsten ore from the Garnet Hill mine in the East Belt district, Calaveras County, was concentrated near El Dorado at the Church mill, operated successively by Church Milling, Inc., and C. A. Gussman. Some tungsten concentrate was marketed.

West Belt District.—Pilliken Mining Co. and Lawrence Skicklig shipped chromite ore and concentrate from the Pilliken mine. Crushed limestone was prepared by California Rock & Gravel Co. at Cool and by Vertin Lime Co. at Auburn for flux, concrete, agriculture, and other uses. The latter company also prepared dimension limestone for use as rubble and dressed building stone and utilized limestone for quicklime and hydrated lime. Soapstone mined by Frank Harris near Latrobe and by Pacific Minerals Co., Ltd., near Shingle Springs was shipped to the San Francisco Bay area for grinding. Rehabilitation work was done on the Sugar Loaf gold mine by the Butler Mining & Development Co., Inc.

Fresno.—Petroleum, natural gas, and natural-gas liquids prepared from wet gas continued to be the principal source of county mineral production. A large percentage of the petroleum and natural-gas yield was from the Coalinga field and the Kettleman field, also in Kings County. The following fields and areas contributed to the county total petroleum and natural-gas output: Burrell, Guijarral Hills, Helm, Jacalitos, Pleasant Valley, Raisin City, Riverdale, San Joaquin, Camden, and Cantua Creek. Natural-gasoline and LP-gas plants were operated at Coalinga by Standard Oil Co. of California and Los Nietos Co., and at Burrell by General Petroleum Corp.

Sand and gravel was produced by the California Division of Highways, the Bureau of Public Roads, and the Forest Service for roadwork throughout the county. Crushed granite was prepared by the Fresno County Commission of Public Works, contractors for the California Division of Highways and Bureau of Reclamation, United States Department of the Interior, for riprap, concrete, and road metal at various localities in the county.

National Hardware & Supply Co. operated a small upgrading plant in Fresno for treating offgrade tungsten concentrates. The principal plant equipment consisted of a rotary roaster and magnetic separator.

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The company also purchased tungsten concentrate in Bishop, Inyo County.

Sand and gravel was produced by L. D. Folsom at Coalinga and by Thompson Materials & Construction Co., Inc., at Avenal. Dimension granite was prepared by Clovis quarries at Academy for rough monumental stone. At Fresno, the Craycroft Brick Co. produced miscellaneous clay for brick manufacture, and expanded perlite was prepared by Perlite Products Co. for plaster aggregate, oilwell drilling fluids, and insulation.

In the Dinkey Creek area, Cal-Tex Tungsten Co. operated the Mud Lakes No. 7 claim and milled appreciable tonnages of low-grade tungsten ores. Allied Tungsten Co. worked the Houghton Bros. mine part of 1954 and shipped tungsten concentrate to an ore buyer.

Idria District.—The Southwest Oil Co. treated low-grade chromite ore from the James-Corbett open-pit mine in the company Joaquin mill at the mine. Concentrate was shipped to the Grants Pass, Oreg., Government Purchases Depot. J. R. Holman operated the Mistake mine, one of the principal chromite producers in the State, and shipped chromite ore and substantial quantities of chromite concentrate. This mine formerly was reported in the Coalinga district. R. E. Ruberts made several shipments of chromite ore from the S. P. No. 1 claim. Mercury ore was mined and shipped to a custom plant by Chris Miranda and Joe Rios from the Archer mine and by Leonard W. Knepper and Walter Reese from the Esperanza (Santa Rita) (Anita) mine. This district lies also in San Benito County.

Kings River District.—Garnet Dike Mine operated the Garnet Dike open-pit and underground tungsten mine and shipped concentrate to buyers. The mine was sold in the latter part of the year to Cal-Tex Tungsten Co. Sand and gravel was prepared by Central Rock & Sand Co. and Sanger Rock & Sand Co. at Sanger. A small quantity of gold was recovered as a byproduct by the former. Crushed basalt was prepared at Piedra by Sharp & Fellows Construction Co. for railroad ballast and other uses.

Little Dry Creek District.—Tungsten concentrate was shipped from the Sycamore claim by Dick George & Leighton McMurtry.

Mill Creek District.—H. E. Donoho worked the Ridge-Hilltop group of tungsten claims and shipped a small tonnage of low-grade ore to a custom mill. Frank Easley shipped tungsten ore to a custom mill from the V. J. Nielson (Delilah) mine. D. O. Whitt shipped a small quantity of tungsten concentrate derived from a mill test on ore from the Dixie Ridge claim.

San Joaquin River District.—Stewart & Nuss, Inc., (Herndon Rock Products), at Herndon, and Pacific Coast Aggregates 1953 Co. Rockfield gravel plant near Friant produced sand and gravel and recovered small quantities of byproduct gold and silver in the sand launders. Merl E. Richards recovered gold from gravel near Friant at Miller Bros. property, using suction equipment. In the Big Creek area, the Southern California Edison Co. prepared sand and gravel and miscellaneous stone for Vermillion Valley Dam. Construction work at the dam was completed November 1954, and the plant has been dismantled. In the Friant area, sand and gravel was prepared by Anderson Rock Plant at Friant and by Pollard Bros. at Pinedale. At Friant, California Industrial Minerals Co. prepared

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pumice, mined in Madera County, for use as a pesticide diluent. Near Mendota, the Marlife Co. produced calcareous marl from its open quarry for agricultural use.

Sycamore Creek District.—Big Creek Development Co. worked the Big Creek claim and shipped tungsten ore to a custom mill. L. L. Touton developed the Red Bud tungsten mine and shipped concentrate. Edgar A. McMurtry & Alfred Benson worked the Jack Pot claim and shipped tungsten concentrate to the Government stockpile. Glen Beinhorn did development at the Ground Hog tungsten claim and shipped a small quantity of concentrate.

Glenn.—The California Division of Highways and the Glenn County Board of Supervisors prepared sand and gravel at various localities in the county. Natural gas was withdrawn from the Afton, Ord Bend, and Willow fields. Sand and gravel was prepared by Orland Sand & Gravel Co. at Orland and by the Southern Pacific Co. at Wyo. Gravel was produced by E. H. Wruck at Willows. A number of chromite mines were active. Cro-Tung Co., Inc., treated chromite ore from the Manzanita and Grey Eagle mines in the company mill. Chromite concentrate was shipped to the Grants Pass, Oreg., Government Purchase Depot. Chester Hill & H. A. Butler worked the West Spring claim and shipped a small quantity of chromite ore. In the Salt Creek area, Robert Clark & Kenneth Evans worked the Black Diamond No. 1 open-pit mine and shipped chromite ore and concentrate. George Anderson did development and explored the Chrome King No. 1 open-pit mine. Chromite concentrate, recovered at a gravity mill, was shipped to the Grants Pass, Oreg., Government Purchase Depot. Harzer Enterprises treated chromite ore from the Harzer open-pit mine in a gravity mill and shipped chromite concentrate. The mill was prepared to handle custom ore.

Humboldt.—The California Division of Highways and its contractors and contractors of the Bureau of Public Roads, United States Department of Commerce, prepared sand and gravel at various localities in the county. Miscellaneous stone for riprap also was prepared by contractors of the California Division of Highways. Natural gas was withdrawn from the Eureka field, and petroleum was produced in the Petrolia area. At Arcata, Eureka Sand & Gravel Co. and Mad River Sand & Gravel Co. prepared sand and gravel for concrete and paving purposes. Tom Hull prepared dimension granite as rubble at Blue Lake for bank protection on Mad River near Sweasey Dam. McWhorter & Dougherty, Inc., prepared gravel near Fortuna for concrete. At Eureka, Hindley Clay Products dug miscellaneous clay from its pits. Chromite ore was shipped by Lynda Haight & Ted Green from the White Cedar claim and by C. F. Starr from the Lassic Peak claim. Mercer Frasier Co. crushed sandstone near Trinidad for riprap and road metal.

Hoopa District.—Providence-Tuolumne Gold Mines continued to explore for copper-zinc ore at the Copper Bluff mine under an amended DMEA contract.

Imperial.—Contractors for the California Division of Highways produced sand and gravel at several localities in the county. Carbon dioxide was withdrawn from the Salton Sea field by Cardox Western, Inc., for dry-ice manufacture. Western Non-Metallics ground mica

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schist from the Micatalc property near Ogilby for use in preparing roofing material. The Holmestake Mining Co. developed the Cargo Muchacho mine for tungsten ore. Tungsten concentrate produced in the company mill was marketed. Claude M. Clapp recovered gold and silver from gravel washed on the Colorado placer claim. Donald Chaney shipped a small tonnage of high-grade tungsten ore to a custom mill from the White Rock claim.

In the Alamo area, sand and gravel was produced at Holtville by Inland Materials Co. and by Valley Transit Cement Co. for concrete, mortar, paving, and filter use. The Farmers Gravel Co. prepared filter sand at Brawley. The Imperial irrigation district crushed granite for riprap at the Hanlon quarry and at the Mount Signal quarry. P. K. Mining & Milling Co. shipped about 1,500 tons of tungsten ore from the Nannie claim to a custom mill for upgrading. At Niland, Superlite Builders Supply Co. prepared pumice for concrete aggregate in building blocks. Near Pichacho, gold and silver were recovered by amalgamating gold ore from the L. P. (Bell) (Mayflower) mine operated by Hazel D. Bratcher. H. & H. Co. produced fire clay and Natural Minerals Co. mined bentonite from their respective open pits near Imperial.

Fish Creek Mountain District.—United States Gypsum Co., largest producer of gypsum in the State, operated the Fish Creek Mountain gypsum quarry and its mill and board plant at Plaster City. This district also lies in San Diego County.

Palo Verde District.—Manganese material, including manganese ore and concentrate and manganiferous ore was shipped to the Government manganese stockpile at Wenden, Ariz., by the following operators: Walter D. Scott (American, Angus, Black Beauty, McIntyre Lugo, and Tadpole mines); W. G. Stewart (Angus No. 2); Marlin & Goodridge and Marlin & Lockwood (Black Beauty); Marlin & Lockwood (McIntyre Lugo, First Chance, and Lost Burrego); George Ringwald (Bright Star and Virginia Queen); A. McIntyre (Jet Black); W. R. Sandoval (La Esperanza); Roy Williams (Lugo); Charles Mills (Mary Ellen No. 1); Jesus Daniels and Stewart & Lockwood (McIntyre Lugo); K. P. Mines (Muller No. 5); Givens & Thing (Tadpole); Bogons & Solarey (Tokay No. 1 and Palo Verde No. 1); and E. J. & E. A. Beutler (Virginia Dare).

Paymaster District.—L. Mills Beam shipped appreciable tonnages of manganiferous ore from the Pioneer underground mine to Government low-grade stockpiles. The Pioneer mine was the largest producer of this material in the State.

Inyo.—Sand and gravel was produced at various localities in the county by contractors for State highway construction. The Los Angeles Department of Water and Power also produced sand and gravel in the county for its own use. Crownite Corp. prepared pumice from the Crownite mine near Coso Junction for concrete aggregate, miscellaneous pozzolana, soil conditioner, and roofing material. Volcanic cinder was produced near Little Lake by Volcanic Cinder Co. for concrete aggregate, soil conditioner, and miscellaneous uses and by Redlite Aggregates for concrete admixture.

In the Slate Range area, Roy Argo continued to develop the Lilly group of claims and shipped a small tonnage of manganiferous

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ore to a Government stockpile. This mine formerly was reported in the Sherman district. Tungsten concentrate from the Hilltop mine was shipped by Frank B. Hudson and Stratton & Wagner.

Tungsten ore also was mined in the Deep Springs area from the Target Tungsten mine; in the Little Lake area, from the Lean Wolf claim by Aldred R. Giraud; in the Saline Valley area, by Russell Roper from the Roper lease; in the Tungsten Hills area, from the Tip Top claim by J. E. Morhardt; and in the Union area by Lund & Thompson who worked the Jumbo claim. P. L. Harris shipped gold ore containing silver from the Black Iron mine near Chloride Cliff to a Nevada copper smelter for flux. Talc was mined by the Huntley Industrial Minerals, Inc., from the White Eagle mine and by the Sierra Talc & Clay Co. from the Eureka mine. Columbia-Southern Chemical Corp. produced soda ash and trona from dry-lake brines near Bartlett for use principally in the glass industry. Bishop Building Materials prepared pumicite produced from the Van Loon pit north of Bishop and in the Paiute area for concrete aggregate. Manganiferous ore produced from the Wonder claim in the Wingate Wash area by D. M. Beach was shipped to a Government stockpile. Fuller's earth was produced from the Cal Clay mine near Tecopa and in the Confidence area by Rock & Mason.

Bishop District.—In this leading tungsten-producing district of California, the United States Vanadium Co., a division of Union Carbide & Carbon Corp., operated the Pine Creek tungsten mine and Morgan Creek mill throughout 1954. This mine was the leading producer of tungsten in the State and also contributed the entire State output of molybdenum from tungsten ore milled. In addition, copper concentrate that contained gold and a substantial quantity of silver that was derived from tungsten ore was shipped to a smelter. Custom and company ore was treated in the 1,000-ton-a-day flotation mill, and the flotation concentrate and low-grade custom concentrate were further treated in digesters to produce synthetic scheelite, the finished product. Brownstone Mining Co. (Brownstone No. 1 & 2, and Myrtle No. 1 & 2 mines) was the fifth largest producer of tungsten concentrate in the State. Other producers of tungsten material in the district were: The Ajax Tungsten Corp. (Tungstar and Hanging Valley); Round Valley Tungsten Co. (Round Valley); Harry David & Andrew Grassel et al. (Shamrock); Sterling Carter and Tungsten Hill Mining Co. (Tungsten Hill); Charles G. & Robert R. Scharf (Yaney); A. H. Peterson (White Line); Ki Enterprises (Basin Mountain); Al Stevens (Big Shot); Gene Bellino (Chipmunk & Hollywood); Paul Priebe (Garnet No. 1); K. C. Moore (Huntley Tungsten City); Foley & Ellis (Jack Rabbit); Moore & Cleland (Johnny Boy); L. Brown & G. Lasley (L. & L.); Richard Moore (Little John); Lee Early, Moore & Stokes (Moonlite); Chas. E. Lindner (Oomph); N. W. Harrah (Peterson); George Lasley (Rossi); Ray & John Harvey (Star Dust et al. claims); Ray & L. B. McMurray (Valley claims); Dick Riley and O. A. Kittle & Associates, Ltd., (Waterfall). Northfield Mines, Inc., explored the Adamson tungsten mine under an amended DMEA contract. The mine operation was leased to Palmer & Decker. El Diablo Mining Co. treated custom tungsten ore and El Diablo mill tailing at the company mill. Mountain States Uranium Co. operated the Red Hill mill on trial mill runs for custom tungsten ore,

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and Ajax Tungsten Corp. treated tungsten ore at the Benware mill. Bishop Engineering & Construction Co. prepared sand near Bishop for paving construction. Huntley Industrial Minerals, Inc., ground talc, pyrophyllite, and soapstone from its Nevada and California mines at Laws.

Cerro Gordo (Keeler) District.—Talc was mined at the Alberta mine near Lone Pine by Wm. & Bernice Bonham, and at the Brooklyn mine by Pat Lenbeck. Sierra Talc & Clay Co. ground company produced and purchased talc at its Keeler grinding mill. This company produced fuller's earth near Olancha and moved clay-grinding equipment from its Los Angeles plant to a new mill at Olancha, north of the Cerro Gordo district.

Coso (Darwin) District.—Miller & Warnken worked the St. Charles mine and mill, the largest tungsten producer in the district, and shipped concentrate to an ore buyer. Other producers of tungsten ore were: Finley & Vignich (Darwin [Silver Reef] mine); Lorenz & Macey, Kerwin & Walker, and R. J. Sandwall (Custer mine); J. Jensen & C. P. Hammoch, Bill Enies, S. Newport, and R. D. Jones (Hollywood claims); John Jenson & Chas. P. Hammoch (Palo Alto mine); Camp Bird Mining & Milling Association (North End mine); Joe McCully (Rain Storm and Saddle Rock) claims; H. R. Mosier (Long Shot mine); L. & W. Tungsten Co. (Silver Reef mine); and L. H. Buckner (Tuscon placer claim). Joe McCully & Crow operated a custom mill on tungsten ore during the year. Joe McCully also milled lead ore from the Empress mine and shipped lead concentrate that contained some silver and zinc to a smelter-fuming plant. Anaconda Copper Mining Co., worked the Darwin group of mines, the leading producer of zinc, lead and silver in California, in the first quarter in 1954. The lead and zinc concentrates produced from the lead-zinc ore also contained some gold, copper, and recoverable cadmium and selenium and were shipped to Utah and Montana smelters, respectively. L. D. Foreman & Co. shipped Lani-mine tailings (part of the Darwin group of mines) to a California smelter-fuming plant. This material contained recoverable gold, silver, lead, and zinc. Louis Warnken, Jr., shipped silver ore, containing lead and zinc from the Christmas Gift mine dump, silver ore containing gold, copper, lead, and zinc from the Lucky Jim claims dump, and lead ore containing gold, silver, copper, and zinc from the Promontory claims dump to a California smelter-fuming plant. Talc was mined from the Alliance mine near Darwin by George W. Koest and from the Frisco and Talc City mines by Sierra Talc & Clay Co.

Fish Spring District.—E. E. Ives recovered gold and silver from gold ore by amalgamation at the Cleveland mine. Valley View Mining Co. did development work at the Valley View and Pinnacle group of tungsten claims. A small quantity of tungsten concentrate was shipped to an ore buyer. United States Mining Corp. produced crude perlite for expanding at plants in the Los Angeles area.

Kearsarge District.—Louis Vetsera produced some turquois for gemstone specimens from the Independence mine near Independence. Barnet Magathan and V. L. Webb pursued development of the El Rey No. 1 & 2 claims and shipped a small quantity of tungsten concentrate.

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Lee District.—McFarland & Hullinger shipped substantial tonnages of lead-zinc ore to a California smelter-fuming plant from the Santa Rosa mine. The ore also contained gold, silver, and some copper. Albert Glenn worked the Silver Reid (Lee) mine and shipped zinc ore, containing silver, lead, and some gold and copper, to a smelter-fuming plant. R. H. McMorris & J. F. Wassen shipped a small tonnage of lead ore containing silver from the Cerrusite No. 1 claim.

Modoc District.—Foreman & Foreman operated the Defense mine and shipped appreciable tonnages of lead ore to a California smelter-fuming plant. The ore also contained silver and zinc and small quantities of gold and copper. A DMEA exploration contract continued in effect at the property in 1954. A shipment of lead ore, containing silver and zinc, from the Minnietta mine to a smelter-fuming plant was made by McFarland & Hullinger.

Resting Springs (Tecopa, Saratoga) District.—Multi Mines, Inc., shipped bentonite from the Desert Queen mine near Shoshone. Talc was mined near Tecopa by Harry Adams, the Kennedy Minerals Co., Inc. (Eclipse mine), and Sierra Talc & Clay Co. (Tecopa mine); and at Shoshone by Louise Grantham & Associates (Warm Springs and Big Talc mines), and Multi Mines, Inc. (Death Valley mine). Copper-lead-zinc concentrate containing silver shipped to a California smelter-fuming plant by the Death Valley Panamint Mining Co. was derived from silver ore produced at the Arcturus mine. Manuel Perry & Son mined and shipped a small tonnage of direct-smelting copper ore containing gold and silver from the Rusty Pick group of claims.

South Park District.—The Doodlebug Mine made a small test shipment of lead ore to an ore buyer from the Doodlebug group of claims. J. S. Havell, Sr., shipped gold ore from the Knob group of claims to a custom mill in Kern County for cyanidation. Gold and silver were recovered. Clair Bros. amalgamated gold ore from the Margaret mine and produced some gold and silver. The Red Cloud Mining Co. (H. E. Briggs) continued to explore the Red Cloud mine for lead-zinc ore under an amended DMEA contract.

Ubehebe District.—Lippincott Lead Mines worked the Lippincott (Lead King) mine. Lead ore containing silver was reduced to lead bullion in the company smelter at Ontario, San Bernardino County, for use in storage batteries.

Wild Rose District.—Gold ore from the Inyo group of claims was shipped to a custom mill for cyanidation by L. R. Markiewitz. Carl D. Dresselhaus shipped gold ore from the Silver Bell mine to a custom mill for treatment. Gold and silver were recovered. Those active in tungsten mining and milling included California Tungsten Mining & Milling Co. and Fred Hinds at the Blue Cliff mine, Thad Green at the Green mine, and Marvin D. Nichols (who worked the Tarantula mine). Hamblin & Roach and White Mountain Mining & Milling Co. shipped tungsten ore from the Happy Easter (Janette and King Size 182) mine and the Skidoo mine, respestively, to custom mills.

Kern.—Interest in uranium prospecting remained high in the county, particularly in the Miracle Springs area. Petroleum, natural gas, and natural-gas liquids from wet gas were the principal mineral commodities produced. Kern County ranked first in the State output of natural gas and liquefied petroleum gases, and second in the yield of both petroleum and natural gasoline. This production was from

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fields that comprise a large portion of the western half of the county. Plants for the production of natural-gas liquids were operated by the following companies (the field locations are in parentheses): Bankline Oil Co. (Maricopa); Belridge Oil Co. (Belridge); Honolulu Oil Co. (Cymric and Taft); Standard Oil Co. of California (Taft, Mount View, Elk Hills, Greeley, and Lost Hills); Superior Oil Corp. (Rio Bravo); Union Oil Co. of California (Belgian Anticline); and Western Gulf Oil Co. (Paloma). Nine petroleum refineries—8 in the Bakersfield area and 1 at Maricopa—had a total crude-oil throughput capacity of 61,450 barrels daily at the close of 1954, a decrease of 12,550 barrels over January 1, 1954.

Contractors for the California Division of Highways prepared crushed granite in the county for road construction. Sand and gravel were prepared by the California Division of Highways and its contractors, the Los Angeles Department of Water and Power and contractors for the Federal Bureau of Reclamation at various locations in the county.

Miscellaneous clay was shipped by Mojave Corp. from Rogers Lake near Boron. Crude feldspar of mixed types was produced by N. W. Sweetser from the Rosamond mine near Rosamond. Pacific Coast Borax Co. produced colemanite (natural calcium borate) from the Jennifer mine at Boron. This mine also supplied raw material for the company boron-minerals plant at Wilmington, Los Angeles County.

Properties worked for tungsten ore included the Lucky Cuss claim in the Woody area, operated by V. E. Zeller; and the Piute Mines Co., Shamrock and Maryetta mines in the Piute Mountains, which yielded 754 tons of ore. The Walabu Mining Co. continued exploring for mercury ore at the Walabu (Cuddeback) mine in the *Keene district* under a DMEA contract. Near Lost Hills crude gypsum was produced by C. L. Fannin, and H. M. Holloway, Inc., for agricultural use. Miscellaneous clay for rotary-drilling fluids was shipped by the McKittrick Mud Co. from a deposit near McKittrick. Groover Mining Co. operated an open pit and mill near Cantil and prepared miscellaneous stone for roofing granules. Hartman Concrete Materials Co. produced sand and gravel for concrete and mortar in the San Emidio area.

Clear Creek District.—J. A. Brinkley shipped tungsten ore to a custom mill from the Moonlight claim. A small quantity of tungsten concentrate derived from Tungsten King-mine-ore was shipped. C. L. Seager & W. Hilton stockpiled tungsten ore from the Tungsten V claim in the course of development.

Greenhorn Mountain District.—Butte Enterprises operated the Butte (Hillside) tungsten mine and shipped concentrate to a Government stockpile. The southern portion of the district north of the Kern River was the locale of extensive prospecting for uranium. The first carload shipment of uranium ore produced in California was taken from the Miracle mine in the Miracle Springs area to a Utah mill.

Indian Wells District.—Hatton & Carlson operated the Hi Peak mine and treated part of the tungsten-ore production in the Kreta gravity mill at Randsburg; the remainder was shipped to a custom mill for treatment. Jack Cowan mined a small quantity of tungsten

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ore from the Squaw claim and shipped low-grade concentrate produced from the ore to an ore buyer.

Kern River District.—Miscellaneous clay for fertilizer was dug by Excel Minerals Co. near Taft and by the Curran Trucking Co. near Bakersfield. Purity Gypsum Mines, near Bakersfield, produced crude gypsum for agricultural use. Structural and paving sand was prepared by C. & H. Materials Co., Dicco, Inc., Edison Sand Co., Griffith Co., and Webster Sand Co., all near Bakersfield. Sand and gravel was prepared by Hartman Concrete Materials Co. and Kern Rock Co., near Bakersfield and by Kern River Rock, Inc., near Oildale.

Kernville District.—Operators of small tungsten mines and claims in the district included the following (the mine names are in parentheses): N. A. Kessler (Buckhorn); Ernest Long (Last Chance); Ellis, Pinnell & Hitchcock (Lucky Strike); Elmer W. Eissler and Robert Martin (Pappy); and C. O. Anderson (Queen Ransom). Abaca Mining Co. continued exploration for antimony ore at the Big Oscar mine under an amended DMEA contract.

Keyes District.—Louis Zellie did some development at the B & F and Last Chance mines and shipped tungsten ore to a custom mill for treatment. Alta Minerals worked the Hobbey mine and shipped tungsten concentrate to an ore buyer. Isabella Mining Co. shipped tungsten concentrate from the Tungsten Buck No. 1 claim, and Liebel & Beatty worked the Unip mine and shipped tungsten concentrate.

Mojave District.—Miscellaneous clay was shipped by the American Mineral Co. from the White Rock mine near Mojave. Dan Leffler shipped a small tonnage of high-grade tungsten ore to a custom mill from the Recondite group of claims. Burton Mines, Inc., operated the Tropico cyanide mill on company and leasee gold ore mined from the Cactus (Cactus Queen) and Tropico (Kid Shaft) and produced gold and silver. Precious metal ores cyanided at the mill on a custom basis included gold ore from the nearby Standard claims operated by E. B. Blickenstaff & J. O'Donnell and silver ore from the Wild Horse claim worked by Jim Popins. Margaret Wegmann made a small shipment of high-grade silver ore from the Wegmann claims to a California lead smelter.

Randsburg District.—William A. Stryker & Louis E. Harrel and the King Solomon Lease operated the Yellow Aster mine. Gold and silver were recovered from the ore by amalgamation at the King Solomon mill. Gold and silver were also recovered by amalgamation by R. C. Porter & Art Krohn from gold ore at the Double Thirteen mine and by Butte Lode Mining & Milling Co., which treated dump ore from the Butte Lode mine. The latter company also concentrated custom tungsten ore in the gravity section of the mill. L. C. Bills produced gold and silver from 30 cubic yards of gravel at the Jim-Tom placer mine by jig. H. C. Brown & Russell Perry recovered a small quantity of gold and silver from the Rosemarie and Esmeralda tungsten placer mines. The Lila King Mining Co. was the largest producer of tungsten concentrate in the Kern County section of the district. That company worked the Victory and Patsy placer tungsten claims, using a dragline excavator. Scheelite was separated from the material in a gravity concentrator equipped with a magnetic

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separator in San Bernardino County about 1 mile east of the claims. Gold and silver were also recovered at the operation. Other operators of small tungsten mines included the following (the mine names are in parentheses): Green & Thorpe and Bert Johnson (Billie Burke); H. C. Brown & J. R. Perry (Rosemarie and Esmeralda); L. C. Bills (Ada R.); W. L. Crumpacker (Golden Wolf); Howard Lovett and Sierra California Mining Co. (Hawk group); Clyde Johnson (Max Hess claims), Adam P. Beaudry (propsected the O. K. group); Charles Stryker (Pearl Wedge); Grigsby & Ward (Rainbow dump); Robert Keeney and Francis J. Hogan (Rose Marie claim); Hugh Higham (Snow White and Blue Jay claims); and L. J. Sain (Bluebird). Dwight C. Boyle produced and shipped a small quantity of manganiferous ore in the course of development at the B & B claim to a Government stockpile.

Red Rock District.—Crude gypsum for agricultural use was produced near Cantil by the Antelope Valley Agricultural Gypsite Co., D. F. Halsey, Mojave Desert Agricultural Gypsite, and Mountain States Uranium Corp. Long Beach Salt Co. recovered salt by solar evaporation from a dry-lake deposit at Saltdale. Calsilco Corp. prepared pumice from its claim near Inyokern, for use in cleansing compounds, acoustical material, paints, oils, and chemical absorbents. W. L. Crumpacker, Jr., shipped a small quantity of tungsten concentrate from the Silk Screen claim. A small tonnage of lead ore from the Cinco mine was stocked at a custom plant.

Tehachapi District.—The Monolith Cement Co. operated its portland-cement plant at Monolith and quarried limestone, clay and silica used in the preparation of the cement. Wm. Anderson worked the Pine Tree claim and shipped a small quantity of tungsten concentrate.

Kings.—Petroleum, natural-gas, and natural-gas-liquids production was the largest contribution to the total county mineral yield. The Kettleman field, which extends into Fresno County, and the Pyramid Hills field were sources of petroleum and natural gas. Natural gas was withdrawn from the Trico gas field, which also lies in Tulare and Kern Counties. Near Avenal, P. S. Magruder operated the Huffman and Western States plants and produced natural gasoline and LP-gases. Standard Oil Co. of California produced natural gasoline. The Caminol Co. petroleum refinery at Hanford had a daily crude capacity of 4,700 barrels at the close of 1954, a decrease of 300 barrels from 1953. Near Avenal in the Kettleman district, crude gypsum was produced by H. M. Holloway, Inc., and McPhaill Gypsum Co., for agricultural use. Sand and gravel was prepared by the California Division of Highways and the Kings County Highway Department and their respective contractors for road construction at various localities in the county. Contractors for the California Division of Highways also prepared crushed granite for concrete and road metal.

Lake.—Contractors for the California Division of Highways prepared crushed sandstone noncommercially for riprap on highway construction in various localities in the county. F. M. Frazel and Lange Bros. Sand & Gravel Co. prepared sand and gravel for paving and structural concrete near Kelseyville.

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Clear Lake (Lower) District.—Cache Creek Gravel Co. prepared sand for paving purposes near Clear Lake Highlands. Near Lower Lake, V. V. Coleman prepared pumice for use in concrete aggregate and plaster and crude volcanic cinder for garden stone.

Clear Lake (Upper) District.—H. L. McCabe prepared sand and gravel at the McCabe Ranch for paving purposes. Lange Bros. Sand & Gravel Co. shipped manganese ore from the Grandview mine to the Government under the carlot program.

East Mayacmas District.—James I. Scott worked the Verbiscio property for chromite subsequently treated in a gravity mill near Middletown. Concentrate was shipped to the Grants Pass, Oreg., Government Purchase Depot. H. W. Gould & Co. explored the Helen mine and treated mercury ore in a 20-ton-a-day capacity 3-by 36-foot rotary furnace. M. L. Burrell retorted mercury ore from the Wall Street mine. Dariel Camp Rock Co. prepared glass sand, sand and gravel for paving and structural concrete.

Knoxville District.—Stanley McCosker explored the Lucky Seven open-pit mine and shipped a small tonnage of chromite ore in the course of development. Chalmers, Davidson & Blackmore made several small shipments of chromite ore from the Shepard claims. The property also extends into Napa County.

Sulfur District.—California Quicksilver Mines, Inc., the third largest producer of mercury in the State in 1954, worked the Abbott underground mine. A Gould-type 40-ton rotary furnace and two "D" retorts to handle condenser mud were operated. Exploration continued under a DMEA contract.

Lassen.—The California Division of Highways, the Lassen County Road Department, and their respective contractors produced miscellaneous stone, sand and gravel, and volcanic cinder at various localities in the county for highway construction. Susanville Granite & Marble Works produced dimension granite for curbing and flagging at Susanville. Grayson Concrete & Materials prepared sand and gravel for mortar and structural concrete. Allie Robinson & W. L. Benge shipped a small quantity of tungsten concentrate from the Leavitt mine. Glass Mountain Pumice Producers prepared volcanic cinder for concrete aggregate.

Los Angeles.—As in 1953, Los Angeles County produced and consumed the largest quantity of minerals in California; it was also the site of several important petroleum refineries and nonmetallic-mineral separation plants. Petroleum, natural gas, and natural-gas liquids from wet gas provided a major part of the mineral production. The county produced the largest amount of petroleum and natural-gas liquids in the State and ranked second in the output of natural gas. Most of this yield was from the Los Angeles Basin, which extends into Orange County, and the Newhall and Castaic areas. Plants for producing natural-gas liquids were operated by the following companies (the field locations are in parentheses): Bankline Oil Co. (Santa Fe Springs); Cowan Oil & Refining Co. (Rosecrans); General Petroleum Corp. (Athens, Santa Fe Springs, and Wilmington); Inglewood Gasoline Co. (Potrero); Lomita Gasoline Co. (Long Beach and Signal Hill); Shell Oil Co. (Brea, Dominguez Hill, and Long Beach); Signal Oil & Gas Co. (Signal Hill); Standard Oil Co. of California (Santa Fe Springs, Inglewood, Seal Beach, and Torrance); Sunray Oil Co.

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(Newhall-Potrero); The Texas Co. (Santa Fe Springs and Signal Hill); Union Oil Co. of California (Santa Fe Springs-Bell, Del Valle, Playa del Rey, Dominguez, Rosecrans, and Sansinena). A total of 25 petroleum refineries in the county (8 at Long Beach, 7 at Wilmington, 2 each at Torrance, Vernon, and Santa Fe Springs, and 1 each at Paramount, Newhall, El Segundo, and Norwalk) had a total crude-oil throughput capacity of 708,000 barrels daily at the close of 1954, a decrease of 9,400 barrels from January 1, 1953. The California Division of Highways and its contractors, the cities of Burbank and Los Angeles, contractors for the United States Army Corps of Engineers, and the Federal Forest Service produced sand and gravel at various locations in the county.

Morrison-Knudsen-Westbrook prepared miscellaneous stone at Little Rock for use in concrete and road metal. John M. Ferry and Transit Mixed Concrete Co. prepared sand and gravel for use as aggregate in building construction near Little Rock.

Brimstone was recovered as a byproduct in the liquid purification of gas by Hancock Chemical Co. near Watson and by Union Oil Co. of Califronia at its petroleum refinery near Wilmington. Expanded perlite was prepared from crude material produced outside the county for use in oil-well drilling, horticulture, filters, and plaster aggregate by Paramount Perlite Co., Inc., near Long Beach. Pacific Coast Borax Co. operated its boron-minerals plant at Wilmington, largely on raw material from Kern County.

Blue Diamond Corp. manufactured cement from purchased clinker at its Los Angeles plant. Expanded perlite, from crude material produced outside of the county, was prepared (chiefly for plaster aggregates) by McClure & Erickson Corp., Panacalite Pacific, Inc., Peerless Perlite Co., United States Mining Corp. and U. S. Perlite Mfg. Co., in Los Angeles. Near Los Angeles plants for grinding soapstone and pyrophyllite were operated by American Minerals Co. and Kennedy Minerals Co., Inc.; for pyrophyllite by Minerals Materials Co.; and for talc by Hill Bros. Chemical Co., Southern California Minerals Co. and Western Talc Co. Near Los Angeles, A. H. Granite Co. prepared crushed granite for use in concrete, road metal, and screenings.

Miscellaneous clay was produced by Atkinson Brick Co., at Compton; J. C. Booth and Davidson Brick Co., at Monterey Park; and Gladding, McBean & Co., at Whittier. Crushed granite for concrete, road metal, and screenings was prepared at Monterey Park by Livingston Rock & Granite, McCaslin Materials Co., and Select Materials Co., and at Montebello by Los Angeles Decomposed Granite and Owl Rock Products Co. James H. Jones (Rio Hondo Co.) prepared sand for paving use, near South Gate.

Great Lakes Carbon Corp. (Dicalite Division) prepared diatomite from the company pits at Walteria for use in filters, insulation, and fillers. Crushed granite was prepared by Livingston Rock & Granite, near Palos Verdes, for concrete, road metal, and screenings. Sand and gravel was prepared for use as aggregate in building and paving by Bill & Rudy's Sand & Gravel near Walteria.

Near Irwindale, Manning Bros. Rock & Sand prepared miscellaneous stone for use in concrete and road material. M. V. Davis crushed and ground vein quartz near Azusa for oil-refinery filtering

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and catalyst use. Sand and gravel was prepared, principally for use as aggregate in building and paving, by the following operators: Blue Diamond Corp.; C. O. Sparks, Inc. & Mundo Engineering Co.; Consolidated Rock Products Co.; Owl Rock Products Co. and Sierra Rock Products Co., all near Monrovia; by Pacific Rock & Gravel Co., near Arcadia; by Arrow Rock Co., near Duarte; Azusa Rock & Sand Co. and Consolidated Rock Products Co., near Azusa; and Century Rock Products and Graham Bros., Inc., near El Monte. San Gabriel Valley Placers recovered byproduct gold and silver from the Azusa Rock & Sand Co. gravel plant, and George M. Knudsen recovered a small quantity of byproduct gold from Graham Bros. gravel plant.

At Los Nietos, miscellaneous clay was produced by Pacific Clay Products Co., and the Sunshine Mica Co. prepared ground mica from imported crude material for use in paints and roofing. Brimstone was recovered as a byproduct by Wilshire Oil Co., Inc., at its petroleum refinery near Norwalk.

Soapstone was mined by Dr. Leon N. Katz from the Katz mine near Acton, and the material was shipped to a grinding plant. MacArthur & Son prepared sand and gravel for use as aggregate in concrete building construction.

Miscellaneous clay was produced by Western Avenue Brick Co. at Gardena. Caswell & Co. prepared sand for glass manufacture near Torrance, and Miller Bros. Truck Co. produced sand for molding use near Torrance and Redondo. Sand and gravel, produced principally for use as aggregate in building and paving, was prepared by Torrance Sand & Gravel Products at Torrance and Chandler Sand & Gravel and Edward Sidebotham & Son, Inc., at Lomita. Columbia-Geneva Steel Division, United States Steel Corp., operated open hearths, rolling mills, and electric furnaces at Torrance.

Miscellaneous clay was produced by Dr. Leon N. Katz at Sunland. Crushed granite was prepared near Sun Valley by Wm. T. Bonfield and California Materials Co. for use in concrete, road metal, and screenings. Sand and gravel was prepared, principally for use as aggregate in building and paving, at Sun Valley by: Arrow Rock Co., Blue Diamond Corp., California Materials Co., Consolidated Rock Products Co., and Livingston Rock & Gravel Co. Sun Valley Tungsten Co. operated a custom gravity treatment plant throughout the year. Roasting and magnetic separation was used in conjunction with a gravity section for final upgrading of custom- and company-produced concentrate.

In the Van Nuys area miscellaneous clay was produced by Angulo Tile Co. and Pacific Clay Products, at Reseda, and Valley Brick & Supply Co., at Van Nuys. Sand and gravel was prepared for use as aggregate in building and paving by Consolidated Rock Products Co. and Granite Materials Co., near North Hollywood. Also at North Hollywood, expanded perlite from crude material produced outside the county was prepared by Kopenite, Inc., and Redco, Inc.

Deepwater Chemical Co., Ltd., and Dow Chemical Co. recovered iodine from oil-well brines at plants in the Dominguez Hill, Venice, and Inglewood fields. Miscellaneous clay was dug near Castaic by Castaic Brick Co. for brick manufacture and near Santa Monica by Gladding, McBean & Co., Higgins Brick & Tile Co., and J. C. Booth. Gold and some silver were recovered from gold ore amalgamated at

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the Black Cargo claims in the Cedar area by P. M. Maynard. In the Claremont district, crushed granite was prepared by Hanawalts for concrete, road metal, and screenings, and sand for paving was produced by West Coast Aggregates Corp. The El Segundo area supplied sand produced by the following: Gordon Transfer & Trucking Co. (molding and blast); McIlroy Blasting Sand Co. (glass); Paramount Sand Co. (sand blasting); and Walter D. Ransom (engine sand). Sand was also produced in Pasadena by Osborne Co. for paving and near La Habra by Lindauer Corp. for concrete and mortar. The area near Newhall contributed mica schist prepared by Robert Cox for flagging and rough slate produced for construction by Don Poteet. A granitic schist for rubble and flagging was produced in the Saugus district by H. A. Jones. Miscellaneous stone was produced on Catalina Island by Graham Bros., Inc., and Conolly-Pacific Co. for riprap, concrete, and road metal.

Madera.—The Bureau of Reclamation, United States Department of the Interior, and contractors of the California Division of Highways produced crushed granite and sand and gravel for county projects. Sand and gravel was also produced noncommercially by the Madera County Road Department and its contractors and by contractors of the Bureau of Public Roads in various localities in the county. Natural gas was withdrawn from the Gill Ranch and Moffat Ranch fields west of Madera.

Cedar Tungsten Mining & Milling Co. continued to develop and explore the Cedar tungsten mine, as did G. McGuire Pierce at the U. S. Tungsten mine. John B. Guillerain & Ed Harlow shipped 20 tons of tungsten ore to a custom mill from the Scorpion open-pit and underground operation in the Raymond area. Raymond Granite Quarries produced dimension granite, principally for monuments.

San Joaquin Valley Pipe & Construction Co. prepared sand and gravel for aggregate near Chowchilla. Tungsten ore was produced from the Mountain View claim in the *Fine Gold* area by Steve Perica. Gold ore amalgamated at the Mountain View-Last Chance mine in the Hildreth area by E. W. Hallstrom & Ben Spies yielded gold and silver. Virgil M. Anderson made a small test shipment of zinc ore from the Silver King claim in the *Minarets* (*North Fork*) district to a smelter.

Fresno River District.—D. J. Yearout recovered gold and silver from 2,000 cubic yards of stream gravel at the Heiskell property, using an 8-inch suction dredge. Elmer Holiday operated a suction dredge on the Noble property and produced gold and silver. Valley Feed & Fuel Co. produced paving sand at Madera.

Jackass District.—Strawberry Tungsten Mines, Inc., worked the Strawberry mine, the third largest producer of tungsten concentrates in the State in 1954. A treatment plant consisting of flotation and gravity separation, roasting, and magnetic separation sections was operated on company ore. Exploration continued under a DMEA contract.

San Joaquin River District.—Thompson Materials & Construction Co. produced sand and gravel by suction dredge north of Kerman. Eventual separation of ilmenite as a coproduct of sand and gravel was considered. Elmer Erickson prepared pumice for concrete aggregate from an open pit near Friant. Ol' Rebel Minerals, Inc., prepared pumicite for insecticide diluent from an open pit also near Friant.

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California Industrial Minerals Co. mined pumicite for shipment to its Fresno County mill.

West Belt (Daulton) District.—H. J. Buchenau operated the Jesse Belle mine and 50-ton-a-day flotation mill. Copper concentrate containing some gold and silver was shipped to a Utah smelter.

Marin.—Contractors for the California Division of Highways crushed miscellaneous stone for riprap, concrete, and road metal at various localities in the county. Near Black Point, Black Point Aggregates, Inc., prepared gravel for aggregate. Sandstone for riprap and aggregate was crushed at the Basalt Rock Co., Inc., McNear quarry and the Hutchinson Co. Greenbrae quarry. Perlite Products Co. expanded perlite for plaster aggregate at Sausalito. McNear Brick Co. quarried shale to be expanded for use in lightweight aggregate, and L. P. McNear Co. utilized weathered shale for brick manufacture at McNear.

Mariposa.—George E. France, Inc., and Ralph E. Maxwell, Jr., prepared gravel for aggregate from several localities, using portable plants. The Mariposa County Highway Department prepared sand and gravel for highway use from various deposits in the county.

East Belt District.—Pacific Placers Engineering Co. developed gold ore at the Clark prospect in the first half of 1954. Gold ore containing silver was amalgamated at a custom mill. Joseph Dupret, Jr., worked the Horseshoe mine and amalgamated gold ore. Gold concentrate containing silver, lead, and zinc was also produced and shipped to a California smelter-fuming plant. Williams Bros. operated the Williams Bros. mine and amalgamated gold ore in a five-stamp mill. Gold and silver were recovered. Other small gold properties that produced gold and silver by amalgamation included: The Schroeder group of claims, operated by C. M. Schroeder, and the Early mine, under surface development by R. H. Jackson. F. S. Harrod & Joe Mihojevich shipped tungsten concentrate from the June Bee mine near Ahwahnee. Incline Mining Co. continued to develop the Blue Dipper and Blue Spot tungsten mines near El Portal and stockpiled ore. A DMEA exploration contract was initiated in 1954. Sierraposa Mining Co. prospected the Garnet King and Garnet Queen tungsten claims, also near El Portal.

Mother Lode District.—Leroy & Duke Richardson amalgamated gold ore from the A. J. mine and also shipped a small quantity of gold concentrate to a smelter. Small quantities of gold and silver were recovered by amalgamating gold ore from several mines, including: Joseph Dupret, Jr. (Black Spider mine); E. W. Ferguson (Louisiana mine); Eugene L. Garbarino & Louis Ferretti (Marguerite prospect); Permit Mining Corp. (Permit mine); Helmuth Lane (Specimen mine); Bryan A. Miller (Annabell mine); and Etta Barnard & S. W. Wilmert (Black Cat claims). Jesse M. Bloyed washed a small quantity of gold from stream gravels at the Red Ball claim. On Mariposa Creek, Mariposa Sand & Gravel Co. obtained byproduct gold from the company sand and gravel operations, and Wm. J. Saye, Sr., produced gravel, using a portable plant. Granite Springs Mining Co. shipped a small tonnage of manganiferous ore from the Granite Springs mine.

West Belt District.—J. T. Morman did some development at the Morman prospect in the first part of 1954. Gold ore amalgamated in a small stamp mill yielded gold and silver.

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Mendocino.—The California Division of Highways and its contractors prepared sand and gravel at various localities in the county. Crushed sandstone for highway construction was also prepared by the California Division of Highways Contractors and the Mendocino County Highway Department at various sites. Sand and gravel was produced by Hans W. Hoyer near Leggett and by C. A. Haun & Sons Gravel Co. near Willits. Sand and gravel was produced by Ford Gravel Co. and Ukiah Gravel & Cement Co. near Ukiah. The Cal Dri Ice Corp. produced dry ice from natural carbon dioxide near Hopland. Herbert & David Filben shipped manganese and manganiferous ores from the Rattlesnake mine to Government stockpiles.

Merced.—The California Division of Highways, Merced County Road Department and its contractors, Bureau of Public Roads contractors, and the Bureau of Reclamation prepared sand and gravel at various sites. Baroid Sales Division, National Lead Co., ground barite from Nevada mines at its Merced plant, principally for drilling mud.

Sand and gravel was prepared by Le Grand Sand & Gravel and by Los Banos Gravel Co. near Los Banos. Agricultural Minerals & Fertilizer Co. produced agricultural gypsum from the Ortigalita Creek Deposit near Los Banos. Sand and gravel was prepared by Cressey Sand & Gravel Co. and Valley Aggregates, Inc., near Cressey, and Turlock Rock Co. near Ballico.

Modoc.—Sand and gravel was produced by the California Division of Highways, the city of Alturas, and Modoc County Road Department, and their respective contractors, for road construction at various sites in the county. The California Division of Highways also produced volcanic cinder for highway seal coat. Its contractors produced miscellaneous stone for concrete and road metal. Sand and gravel was prepared by Moyer Gravel Co. for paving and building near Alturas.

Boorman Pumice Products and Glass Mountain Pumice Producers prepared pumice for use as lightweight aggregate from their deposits near Tionesta. Volcanic cinder for ballast and fill was produced by the Great Northern Railway Co. from the Ainshea Butte quarry, also near Tionesta. Modoc Peat Moss Co. dug moss peat for use as fertilizer from beds in Jess Valley near Likely.

Mono.—Sand and gravel was produced by the California Division of Highways, the Mono County Highway Department, and their respective contractors, and the Forest Service from various sites in the county.

In the Bishop area, Scharf, Scharf & Schwerin operated the Nicoll (Mountain View) mine and shipped tungsten ore to a custom mill for treatment. Mount Whitney Tungsten Co. mined tungsten ore from the Scheelore and Catherine claims and shipped tungsten concentrate to ore buyers. Gerald Hartley shipped tungsten ore to a custom mill from the Hilton Creek mine. Walter Thomas (Piute Mining & Milling Co.) operated a custom mill on local tungsten ores.

Blind Spring Hill (Yellow Jacket) District.—R. H. Wallace did development work on the M. & W. claim and shipped tungsten ore to a custom mill for treatment. Cowan & McGraw prepared pumice for use in lightweight aggregate near Benton.

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Chidago (Clover Patch) (Indian) District.—Wah Chang Mining Corp. operated the Black Rock mine, the second largest producer of tungsten concentrate in California in 1954. Of the total ore produced in 1954, about 70 percent was from the underground operation and the remainder from an open pit. Most of the ore was treated at the company flotation-chemical plant, but some was shipped to an Inyo County custom mill for beneficiation. Exploration continued at the mine under a DMEA contract for part of 1954. A. L. Gardner worked the Granite group of claims in the early part of the year and shipped a small quantity of tungsten concentrate.

White Mountain District.—Pumice was prepared near Bishop for use in lightweight aggregate and acoustic plaster by Andrew Boyd, the Insulating Aggregates Co., and Jamieson Pumice. Huntley Industrial Minerals, Inc., shipped pyrophyllite from the Pacific Pyrophyllite open-pit mine to its Laws grinding plant. This district extends into Inyo County.

Other Districts.—Tungsten ore was produced in the Gull Lake area from the Black Jack claim, and in the West Walker district from the Lone Star claim by Fred Ady. Tungsten Associates, Ltd., explored the Saddlebag Lake claim in the Tioga district for tungsten ore and did some development work. Gold and silver were produced by C. E. Beauregard from the Sierra-Washington claims in the Mammoth Lake district and by Valley View Mines Co. operating the Sarita group of mines in the Masonic district. Ore from the Sierra-Washington claims and some ore from the Sarita mines was cyanided at the Masonic mill near Bridgeport. Small tonnages of concentrate and ore containing gold and silver were also shipped to a California smelter from the Sarita mines. In the Mono Lake area U. S. Pumice Supply Co., Inc., prepared pumice at its Lee Vining mill for abrasives. The crude material was from the Mono Crater quarry. A small tonnage of silver ore was shipped to a California smelter from the Leecher mine, in the Patterson (Sweetwater) district, by D. A. Jacobs & A. G. Williams. Huntley Industrial Minerals produced kaolin from its pit near Casa Diablo in the Hot Creek district largely for stucco and as filler in paint and rubber.

Monterey.—The California Division of Highways, and the Monterey County Highway Department, and their respective contractors prepared sand and gravel at several sites for county highways. Petroleum and natural gas were produced at the San Ardo field in the southern part of the county.

Kaiser Aluminum & Chemical Corp. prepared refractory magnesia, caustic-calcined magnesia, and magnesium hydroxide at the company Moss Landing plant from sea water and calcined dolomite produced in the county. Near Pacific Grove, Del Monte Properties Co. produced sand products for a variety of purposes from dune material. Feldspar and silica were recovered from the natural sand mixture by flotation, and a part of each product was ground for ceramic uses. The company also quarried decomposed granite at Pebble Beach for aggregates. Dune sand was also utilized by Owens Illinois Glass Co. to produce sand for glass and miscellaneous uses. Sand for structrual and other uses was produced by Monterey Sand Co. near Seaside and Marina and by Pacific Coast Aggregates, Inc., near Castroville and Marina. Structural sand and gravel was prepared by M. J. Murphy,

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Inc., near Carmel, and gravel for paving was produced by Max Cazin near Greenfield. Dimension sandstone for rough construction was prepared by the Carmel Stone quarry. Monterey Bay Salt Works recovered 8,400 tons of salt by solar evaporation from ponds near Moss Landing.

Kaiser Aluminum & Chemical Corp. quarried limestone at the Natividad quarry 6½ miles northeast of Salinas. Some of the material was used for metallurgical fluxes, but most of the output was calcined at the Natividad plant to produce quicklime for refractory and chemical use.

Napa.—Napa County produced dimension sandstone for rubble and crushed sandstone for aggregate. Contractors for the Bureau of Reclamation crushed sandstone for riprap and aggregate at several sites in the county.

At Napa, Basalt Rock Co., Inc., crushed basalt from the Pedrotti quarry for riprap and aggregate and prepared diatomite from the pozzolan pit by kiln-firing and crushing, for use in pozzolan cement. This company bloated bentonitic shale from its Solano County pit, at Napa Junction, for aggregate. Sand and gravel were produced by the Benson Gravel Plant near Angwin. Sand and gravel was prepared at St. Helena by McGill Rock & Sand Co. Perlite Aggregates, Inc., quarried crude perlite at the Alvo quarry and expanded perlite at its St. Helena plant.

East Mayacmas District.—Lauriano Juarez produced mercury by retorting placer and dump material from the James Creek and Oat Hill properties, respectively. J. G. Goodwin recovered mercury by chemically treating a cinnabar concentrate produced from placer material on the Williamson lease. The concentrate was treated in a sodium sulfide solution, which dissolved the cinnabar in the presence of sodium hydroxide. The mercury was then precipitated from a nearly saturated solution on aluminum scrap.

Knoxville District.—William Allendale & Edward Hadsel operated the Black Charlene underground open-pit mine and shipped chromite ore and concentrate to the Grants Pass, Oreg., Government Purchase Depot. The milling ore was treated at a nearby concentrator. Lunium Co., Inc., operated the White Angel opencut-underground mine the first part of 1954 and shipped chromite ore and concentrate. The company operated a gravity mill adjacent to the mine. Chalmers, Davidson & Blackmore worked the Shepard claims, which extend into Lake County, and operated the Lunium mill in the latter part of the year. Chromite ore and concentrate were shipped. Reed Harris shipped a small tonnage of chromite ore from the Rock claim. Ray Adams retorted cinnabar, recovered from dump material at the Knoxville mine by placering, and produced mercury.

Nevada.—Contractors for the California Division of Highways and the city of Grass Valley and the Nevada County Highway Department produced sand and gravel from several county deposits for road construction. Contractors for the California Division of Highways also produced crushed granite for riprap and road metal for highway construction.

French Corral District.—L. M. White recovered 2 ounces of gold from 145 cubic yards of placer tailings washed at the Atomic claim.

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Gold and silver were also recovered from placer gravels in the district by prospectors and itinerant miners.

Grass Valley-Nevada City District.—Empire Star Mines Co., Ltd., the third largest producer of gold and the leading lode-gold mine in California in 1954, and lessees operated the Empire Star group of mines, consisting of the Empire, North Star, and Pennsylvania, and a 500-ton-a-day mill. Gold and silver were recovered from company gold ore and some custom concentrate by amalgamation and cyanidation. Idaho Maryland Mines Corp., fourth in production of gold and second largest lode-gold mine in the State, worked the Brunswick mine and the 600-ton-a-day Idaho Maryland mill. Gold and silver were recovered from the gold ore by amalgamation, and concentrate shipped to a California smelter yielded gold, silver, and some copper. This company began to explore and develop a tungsten ore body, also in the Brunswick mine. Some tungsten concentrate produced in the company pilot plant was marketed.

Washington (North Bloomfield) District.—Red Ledge Mines explored the Red Ledge mine by opencuts. Gold ore produced was amalgamated at the company mill and yielded gold and silver. The Espy Mining Co. operated the Espy placer claims on the Middle Fork of the Yuba River, using a dragline excavator. Gold and silver were recovered. Other placer properties that produced gold and silver included the Rocking Chair drift mine (R. L. Dooley) and the Superior claims (J. A. Crowley).

You Bet District.—M. W. & A. Dredging Co. made test runs on gravel excavated at the company property by a 1¾-cubic-yard capacity dragline and produced gold and silver. A treatment plant was still under construction. Louis Popper produced some gold from the Red Dog placer claim in the course of development.

Orange.—The value of petroleum, natural gas, and natural-gas liquids from wet gas was the largest single contribution to Orange County mineral production in 1954. This yield was from the Los Angeles Basin, which extends into Los Angeles County. Natural-gas-liquids plants were operated by the following companies (the field locations are in parentheses): Brea Canyon Oil Co. (Brea Olinda); Fullerton Oil Co. and Signal Oil Co. (Huntington Beach); Richfield Oil Co. (Brea); Standard Oil Co. of California (Huntington Beach and Murphy Coyote); Union Oil Co. of California (Richfield and Brea Olinda-Stearns); and West Coast Refining Co. (Richfield). Two petroleum refineries at Huntington Beach had a total crude-oil throughput of 7,100 barrels daily at the end of 1954, an increase of 300 barrels over January 1, 1954. At Seal Beach, Dow Chemical Co. produced iodine from oil-well brines. Contractors for the California Division of Highways and the United States Navy produced sand and gravel for road construction from various deposits in the county.

Sand and gravel was produced near Anaheim by Burris sandpit, Longsdon sand plant, McClellan & Sons sandpit, and James Sparkes sandpit. Most of the material was for aggregate in building and paving. D. D. Lawhead & Sons produced yellow decomposed crushed granite for road surfacing.

Gladding, McBean & Co. produced fire clay from the Claymont mine near Corona, and Pacific Clay Products dug miscellaneous clay from an open pit on the Irvine property.

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Near Huntington Beach, gravel was produced by Bruce Bros. for building construction, and La Bolsa Tile Co. produced miscellaneous clay. R. W. McClellan & Son and Peat Sales Co. produced peat humus used for soil improvement.

In the San Juan Capistrano area sand and gravel for aggregates was produced by Graham Brothers, Inc., and Gladding, McBean & Co. produced fire clay from the company pit.

Near Orange, sand and gravel was prepared by Consolidated Rock Products Co. (largest producer in the county), California Rock Co., Foster Sand & Gravel Co., A. E. Fowler & Sons, R. J. Noble Co., and Orange County Rock Products; at Santa Ana, by Miller Bros. Truck Co.; and near El Modina, by Sully-Miller Construction Co.

I. P. Arnold produced a kaolin-silica sand mixture for use in refractory furnace lining, and W. A. Shoeppe produced kaolin near El Toro. In the Newport area, V. J. Frye prepared molding sand, and Western Salt Co. recovered salt from sea water by solar evaporation. Mission Clay Products Corp. produced miscellaneous clays near Olive. C. C. Jenkins shipped a carload of zinc ore containing gold, silver, copper, and lead from the Blue Light (Silverado) mine in the Silverado area to a Utah smelter-concentrator.

Placer.—Contractors for the California Division of Highways, the Bureaus of Indian Affairs and Public Roads, Forest Service, crews of the Placer County Road Department, and the Forest Service prepared sand and gravel for aggregate in road construction from various deposits in the county.

Damascus (Pioneer) District.—Joseph Delmue developed the Bear Wallow and Daisy Bell underground open pit mines and shipped chromite ore. Square-set stoping was employed underground. J. J. Stephenson & H. C. Dixon worked the Eisenhower open-pit mine by bulldozer and shipped high-grade chromite ore.

Last Chance District.—Gold and silver were produced by the following: George S. Wheeler from quartz ore amalgamated at the Grizzly mine; Sturgill & Son from ground-sluiced gravel at the American Hill mine; Anderson Development Co. from 2,000 cubic yards of gravel excavated by bulldozer at Canada Hill; and William Schladetz & August Regenass from washed placer tailings from the Last Chance mine.

Lincoln District.—At Lincoln, Gladding, McBean & Co. dug plastic fire clay from the Lincoln and Atkinson pits for use at company plants, and Lincoln Clay Products Co., Inc., shipped plastic fire clay.

Rocklin (Loomis) District.—Dimension granite was produced near Rocklin by Union Granite Co. for use as building and monumental stone. T. Rickey and S. Gray washed gravel produced from the Murdock (Lee) drift mine and recovered gold and silver.

Other Districts.—Gold and silver were produced on a small scale at the following placer properties (the names of the operators are in parentheses): John Avery property (Leslie Darrington), *American River (Folsom) district;* Dead Deer placer claim (Jack Hancock), *Dutch Flat district;* Homestake mine (A. K. McCollum), Paragon hydraulic mine (W. E. Wilson), Occidental drift mine (C. & H. Leasing Co.), Big Stump mine (D. G. Pettit), Gleason drift mine (C. D. Livingston), Twenty One mine (W. E. Thompson), and Virtle mine (A. W. Simpson), *Iowa Hill district;* and Oro (Willies) mine (Anderson

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Development Co.), *Michigan Bluff district.* Sand and gravel was produced by Joe Chevreaux, near Auburn, and Bear River Sand & Gravel Co. and Marshall Miles Gravel Co., near Colfax. The Union Pacific Railroad quarried and crushed miscellaneous stone near Baxter for railroad ballast, and J. T. White crushed miscellaneous stone near Meeks Bay for building construction.

Plumas.—The California Division of Highways, the Plumas County Road Department, and their contractors produced sand and gravel for use in road construction from various deposits in the county.

Butte Valley (Seneca) District.—A. L. Kast operated the Good Luck mine and shipped a small tonnage of chromite ore.

Greenville (Crescent Mills) District.—J. W. & S. D. Hoeffler mined and amalgamated gold ore from the Dag-Ian (L. & L.) mine in the early part of 1954. Gold and silver were recovered. William Rush explored the Timber Trail group of claims by drifts and shipped a carlot of copper ore containing some silver to a Utah smelter. Lakeview Manganese Mines exploration contract with DMEA remained in effect, but no activity was reported during the year.

Other Districts.—Gold and silver were produced on a small scale by: B. R. Cooke, Sr., from tailings at the Crown Point placer mine in the *Genesee Valley district;* J. L. Snoderly & Charles Bryson from gravel tested at the Italian mine, and R. E. Murray from gravel washed at the Sly Fox claim, both in the *Johnsville district;* and R. L. Hollingsworth from stream gravel at the Finnaly group of claims in the *Sawpit Flat district.* In the Feather River area, the Western Pacific Railroad Co. quarried granite near Tobin for riprap, and Laswell Bros. rock plant prepared sand and gravel near Quincy for aggregates.

Riverside.—The California Division of Highways, the Riverside County Highway Department, and their contractors produced sand and gravel for road construction from various deposits in the county.

In the Beauty Peak area tungsten concentrate was shipped by Sidney Grossman from the Pawnee claim to a custom mill. Near Elsinore, plastic clay was produced by Alberhill Coal & Clay Co., Elsinore Clay Co., and Gladding, McBean & Co. (Sloan pit). The Pacific Clay Products Co. produced miscellaneous clay from the Murphy pit and Douglass pit at Alberhill. Also near Alberhill, the Los Angeles Brick & Clay Products Co. produced plastic fire clay and miscellaneous clay.

Miscellaneous clay was produced by Atlas Sewer Pipe Co., Liston Brick Co., and Pacific Clay Products Co. near Corona. The Sky Ranch Clay Co. produced plastic fire clay from the Sky Ranch pit, and Gladding, McBean & Co. produced both plastic fire clay and miscellaneous clay from the Harrington pit. Colored sand and flint sand for glass were produced by Owens Illinois Glass Co. Minnesota Mining & Manufacturing Co. prepared artificially colored roofing granules from miscellaneous stone. This district extends into Orange County.

Earl K. Geiger developed the Duplex mine in the Dale area, chiefly by drifting and crosscutting. A small tonnage of gold ore amalgamated at the mine yielded gold and silver. United States Gypsum Co. manufactured plaster and plasterboard at its Midland plant from gypsum quarried nearby.

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Ike W. Kusisto shipped appreciable tonnages of manganiferous and manganese ores from the Black Ace open-pit mine in the Palen Mountain area to a Government stockpile.

In the Palo Verde area, George Ringwald shipped a small tonnage of manganiferous ore from the Lucky Boy mine to a Government stockpile.

Riverside Cement Co. operated the Crestmore portland-cement plant on limestone from the Crestmore underground mine and the Jensen quarry. Triangle Rock & Gravel Co. produced sand and gravel near Mira Loma. Near Riverside, granite was crushed by Haven Granite Corp. for poultry grit and by J. B. Stringfellow Co. for riprap. National Quarries produced granite as rough architectural building stone. At Box Springs, granite was quarried for riprap by the Atchison, Topeka & Santa Fe Railway Co.

Sand and gravel was produced by Desert Rock Co., at Garnet; Palm Springs Builders Supply Co., Ltd., at Palm Springs; San Gorgonio Rock Products Co., at Banning; and Valley Rock & Sand Corp., at San Jacinto. Some amphibole asbestos was mined from the Catherine C. mine near Mountain Center.

Chuckawalla District.—Darnell, Becker & Co. and Roy M. Bars, lessee, operated the Cap Hunter mine and shipped gold ore to an Arizona custom mill for treatment. The lead concentrate, containing gold, silver, and copper, derived from the gold ore, was shipped to a Texas smelter. E. T. Herman & George Keller produced a small tonnage of pyrophyllite from the H. & K. mine near Desert Center. Earl Sweeney shipped tungsten concentrate produced at the Matilda group of claims.

Eagle Mountain District.—Kaiser Steel Corp. operated the Eagle Mountain iron mine and beneficiating plant throughout 1954. Although the grade was higher, the total tonnage of magnetite-hematite ore shipped to the company blast furnaces at Fontana (San Bernardino County) was 20 percent less than in 1953. Carl Saure shipped a small tonnage of copper ore to a smelter from the Copper Belt mine.

Ironwood (McCoy) District.—Manganese concentrate, manganese ores, and manganiferous ores were shipped to Government stockpiles by the following operators (the mine names are in parentheses): J. F. George (Bertha); Clay Hunsucker (Black Beauty); Blythe Manganese Co., Inc. (Black Jack); California Limestone Products, Manganese Co. of California, and William B. Tenny (Langdon); and Dan Figueroa & Sons (Manganese Canyon and Black Jack). This district was the second largest contributor of manganese material in the State. California Limestone Products Co. marketed wollastonite float rock found near Blythe for use as ornamental building stone. Float rock only was shipped because its weathered surfaces give it the appearance of drift wood.

Sacramento.—Natural-gas yield, fourth highest in the State, was derived from the Freeport, Thorton, River Island, and Rio Vista fields. The last field extends into Solano and Contra Costa Counties. Contractors for the California Division of Highways and the United States Army, Corps of Engineers, produced sand and gravel for road construction from various deposits in the county.

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Cannon & Co. produced miscellaneous clay at Michigan Bar on Consumnes River. Sand and gravel was produced by Asta Construction Co. near Rio Vista. This property extends into Solano County. At Sacramento, Harms Bros. prepared sand and gravel using portable equipment, and Harrison Fait and the Sacramento Brick Co. produced miscellaneous clay for brick manufacture.

American River District.—The Natomas Co., second largest producer of gold in California, operated a fleet of five bucketline dredges on placer ground near Folsom throughout 1954. Silver and platinum were also recovered. According to the annual company report, gross production in the district has decreased only 5 percent since 1952, despite a 15-percent reduction in number of operating dredges. Unit operating costs in 1954 remained at approximately the 1953 level. Byproduct gold and silver were recovered incident to sand and gravel production at plants of the following companies: American River Sand & Gravel Co., Fair Oaks Gravel Co., Merritt Chapman-Scott Corp. & Savin Construction Co., Haggin Gravel Co., Del Paso Rock Products Co., and Brighton Sand & Gravel Co. J. D. Fippin & A. R. Vincent explored the Little White Rock mine. Gold and silver were recovered from a small tonnage of gold ore amalgamated in a two-stamp mill. Other producers of sand and gravel were: A. Teichert & Son, Inc., McGillivray Construction Co., Robertson Sand & Gravel Co., Robert Powell Products, Inc., and Pacific Coast Aggregates, Inc.

San Benito.—A relatively small production of petroleum was reported from the Ciervo, Lomerias, Vallecito, and Bitterwater areas. Natural gas was withdrawn from the Hollister field. The California Division of Highways, the San Benito County Road Department, and their contractors produced gravel for road construction from several county deposits.

Westvaco Mineral Products Division, Food Machinery & Chemical Corp., quarried dolomite from the Hollister quarry, principally for the production of magnesia at the company Alameda County plant. San Benito Bentonite Co. produced a small tonnage of bentonite from its pit near Tres Pinos.

Ideal Cement Co. operated its San Juan Bautista portland-cement plant formerly owned by Pacific Portland Cement Co. The company produced limestone and shale for raw materials in cement manufacture from nearby quarries. Granite Rock Co., the largest producer of granite in the State, crushed the material at its Logan quarry.

Idria District.—New Idria Mining & Chemical Co., largest producer of mercury in both California and the Nation in 1954, treated ore from the New Idria (including the San Carlos) mine. Four 100-ton-a-day, 5- by 56-foot Gould rotary furnaces and condensing systems were used. A DMEA contract was active on the New Idria-West Idria section of the property. The operation was described in an article.[4] Other mercury producers in the district were Reyes Diaz (Aurora dump); Oda Sherrod (Loueldon mine); Leonard W. Knepper (North Star mine); Juan Carrillo (Santa Marguerita mine); and Paul Gonzales & Joe P. Larios (Wonder mine). James Mining Co. operated the Saw Mill Creek open-pit mine and concentrated chromite ore at the San Benito gravity mill. Some chromite ore from Mistake mine in

[4] Engineering and Mining Journal, vol. 155, No. 10, October 1954, pp. 86–89.

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the Fresno County part of the district was also treated at the plant. The chromite concentrate was shipped to the Grants Pass, Oreg., Government Purchase Depot.

Panoche District.—Raymond Lucas shipped mercury ore from the Lucky Star mine and the Spanish claim to the Idria district for treatment, as did Trevis Berry from the Cerro Bonito claim and Jerome Elisondo from the Wild Turkey claim. Louis Sciocchetti recovered mercury by retorting ore from the Juniper underground mine.

Stayton District.—Edward Matthews & Arthur Pearce did some development work at the Pacheco mine and shipped manganiferous ore to a Government stockpile.

San Bernardino.—The Bureau of Reclamation produced granite and limestone for riprap and road metal at county projects. Gravel was produced by contractors for the California Division of Highways, San Bernardino Highway Department, the Bureau of Reclamation, and the Forest Service. Sand and gravel was prepared by contractors for the United States Marine Corps. There was a relatively small petroleum production from the Chino-Soquel area.

California Dolomite Co. produced crushed limestone for roofing granules near Adelanto. Otto H. Wismer shipped tungsten ore to a custom mill from the Rabbit Hole mine. Other operators of tungsten properties in the Adelanto area were: Jones & Mort (Princess Pat mine); Parita Placer (Parita placer mine); Milky Way Mining Co. (Milky Way mine); D. C. & Joe McCulley (Red Raven mine); and W. H. Pinchback (Mary Ann mine).

Western Talc Co. produced talc from its mine 7 miles southeast of Tecopa. The raw material was shipped to the company grinding plant at Dunn for primary crushing and then to its Los Angeles plant for final grinding.

Sand and gravel was produced by Dana Materials Co. near Dagget. In the Barstow area, Brubaker-Mann Co. and the Rainbow Rock Co. quarried miscellaneous crushed stone for roofing granules. Barstow Rock & Gravel Co. produced sand and gravel as aggregate in building construction. San Antonio Mining Co. shipped zinc ore, containing some gold, silver, and lead, from the San Antonio (Golden Witch) mine to a Utah custom mill.

Mineral Material Co., near Cushenbury Spring, produced crushed limestone for metallurgical flux. Frank Day & Co. produced a small quantity of gravel near Big Bear Lake for paving use. Lead-silver ore from the Sheri La Don claim was stockpiled at a custom mill for future beneficiation.

Bristol Lake District.—California Rock Salt Co. recovered liquid calcium chloride from well brine at Saltus, and Hill Bros. Chemical Co. recovered flake calcium chloride. National Chloride Co. of America produced liquid calcium chloride from dry lake brines near Amboy, and California Rock Salt Co. recovered rock salt from well brines by solar evaporation.

California Perlite Corp. quarried crude perlite near Ludlow.

Kaolin was produced by Gladding, McBean & Co. and Southern California Minerals Co. at Hart and by B. & W. Tile Co. from the C. & M. pit. The Union Pacific Railroad Co. produced gravel for railroad ballast from the Basin gravel pit near Baxter. Western Talc Co. operated a primary grinding plant for talc at Dunn.

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In the Cuyamaca area, Royco Mines operated the Sundown mine and shipped tungsten ore to a custom mill for treatment. Creese Bros. shipped tungsten concentrate from the Valley View mine to a custom mill. Valle's Mining Syndicate explored the Old Ironside prospect in the Foster area for nickel ore by core drilling under a DMEA contract in 1954. Activity ceased in the latter part of the year.

Lucerne Valley Engineering Co. produced dimension granite in Lucerne Valley for use as architectural building stone.

Kaiser Steel Corp. operated its blast furnaces and steel mill at Fontana on ferrous scrap and iron ore from the Eagle Mountain mine in Riverside County. California Portland Cement Co. operated its Colton plant, using company-quarried limestone. This company also prepared quicklime and hydrated lime for the building industry. Commercial producers of sand and gravel follow: Central Rock & Sand Co and Consolidated Rock Products Co. (Upland); Fontana Gravel Co. (Fontana); Fourth Street Rock Crusher, San Bernardino Rock & Gravel Co., and Triangle Rock & Gravel Co. (San Bernardino); Hanawalts (Pomona); Tri-City Rock Co. (Redlands); Service Rock Co. (Colton); and Holliday Rock Co. (Colton and Claremont). Nu-Lite Insulated Homes, Inc., operated a perlite-expanding plant at Fontana on crude perlite obtained from the company mine in Clark County, Nev. Miscellaneous clay was dug by the Pomona Brick Co. from the company pit near Chino and by Hancock Brick Co. from its pit near Highgrove.

The American Potash & Chemical Co. recovered borax, boric acid, sodium tetraborate, bromine, soda ash, salt cake, potassium bromide, potassium chloride, potassium sulfate, and crude lithium phosphate from dry-lake brines at the Searles Lake Trona Plant near Trona. The West End Chemical Co. recovered borax and soda ash at its plant near West End. This company quarried limestone in Searles Valley for the carbon dioxide and lime used at its plant. Pacific Salt & Chemical Co. recovered rock salt from dry-lake brines, also near Trona.

In the Ship Mountains area L. J. Rouchleau shipped tungsten ore to a custom mill from the Hidden Value mine.

Talc was produced by Southern California Minerals Co. from the Acme and Bonnie mines about 18 miles north of Baker. Dell Canady explored at the Silver Dell claim and shipped a few tons of lead ore containing some silver to a smelter.

Talc was produced about 30 miles northwest of Baker by: B. F. J. Mining, Inc., from the B. F. J. mine; Saratoga Talc Co., from the Saratoga mine; and Southern California Minerals Co., from the Superior mine. The material was sent to the company grinding plant in Los Angeles. Talc was mined by Sierra Talc & Clay Co. from the Sheep Creek mine about 24 air miles northwest of Baker and shipped to company grinding plants at Keeler, Inyo County, and Los Angeles.

Talc was produced by the following: Desert Talc & Clay Co., from its mine near Paso Alto; Sierra Talc & Clay Co., from the Silver Lake No. 1, Silver Lake Addenda, and Gould Tunnel properties; and Southern California Minerals Co., from the Calmasil mine. All these properties are in an area about 10 miles northeast of Baker.

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Lithia Tungsten shipped concentrate derived from ore produced at the Lithia claims in the Soda area.

Kenneth J. De Los Rios produced bentonite from the Summit pit near Rademacher for experimental purposes.

Clyde B. Aitchison, Jr., did development work at the Starbright mine in Lane Mountain area and shipped tungsten ore to a custom mill.

Alvord District.—Thompson & Bender shipped tungsten ore to a custom mill from the Starlight claim.

Black Hawk District.—Frank Czerwonka shipped gold ore containing silver to a Kern County custom-cyanide mill from the Rambler-Hilltop mine. The ore body was under development from a winze.

Buckeye District.—Burns & Smith Consolidated Mines shipped fluxing ore from the Bagdad-Chase mine to several smelters. The ore contained gold, silver, and copper.

In the Cady Mountains area, Stovall Manganese Co. operated a jig concentrator at Poe's Station for treating siliceous manganese ore from the Big Reef (Van Dorn) and Lee Yim (Garringer) mines. Manganese concentrate was shipped to a Government stockpile. Bert Craig and Lee W. Yim also shipped ore from the Lee Yim (Garringer) mine. Great Western Consolidated Mining & Milling Corp. did some development at the Black Marvel manganese mine and experimented with a magnetic separation process for ore concentration. Manganese concentrate was shipped to a Government stockpile.

Cima District.—R. O. Jones and the Mahoney-Morrison Co. worked the Bright Outlook mine for a short time in 1954 and shipped a small tonnage of tungsten ore to a custom mill.

Clark Mountain District.—Molybdenum Corp. of America operated the Mountain Pass mine and mill and separated rare-earth-metal concentrate from the barite-carbonate rock. Columbia Mining Co. shipped tungsten concentrate from the Columbia claim.

Dale District.—Marblelite Building Stone Co. began quarry operations near Twentynine Palms producing dimension stone from rough rhyolite. Buckelman & Sybrandy recovered salt by solar evaporation from well brines. H. M. Chambliss treated gold ore from the Ivanhoe mine and shipped concentrate containing gold and silver to an Arizona smelter.

Ivanpah District.—New Trail Mining Co. operated the New Trail mine by lease for a short time in 1954 and shipped copper ore containing gold and silver to a smelter.

Kingston District.—Talc was produced by the Southern California Minerals Co. from the Excelsior mine about 40 miles northeast of Baker.

Lava Bed District.—Bentonite was produced by the Inerto Co. from the Geyser View No. 3 claim near Hector and by National Lead Co., Baroid Sales Division, from the Hector mine near Daggett. Bessemer Iron Corp. explored the Bessemer mine for iron ore by core drilling under a DMEA contract.

Morongo District.—Harry A. Sill made a test shipment of tungsten ore from the Rose Prince claims to a custom mill, and Rice & Cone shipped tungsten ore to a custom mill from the Wheel Barrow claim.

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Newberry District.—Sharp & Fellows Construction Co., near Newberry, produced crushed miscellaneous stone principally for railroad ballast.

Ord Mountain District.—Rainbow Rock, Inc., worked the Fred Welk (McInery) claim and shipped tungsten concentrate to ore buyers.

Owl Hole District.—Walter Davis shipped several carloads of manganese and manganiferous ores from the Black Magic mine to a Government stockpile. Owl Head Manganese Mines operated the Owl Head mine and shipped manganiferous ore.

Providence (Arrow) District.—Thomas E. Creed shipped a small tonnage of dump ore to a smelter from the Barnett (Beverly Glen) claim. Gold, silver, lead, and some copper were recovered. Stephan Mining Co. treated some gold ore from the Stephan mine and shipped concentrate containing gold and silver to a smelter.

Randsburg District.—Surcease Mining Co. operated the Atolia group of mines, the fourth largest producer of tungsten concentrate in the State in 1954. The company operated a gravity mill for treating company and leasers ore and a flotation section for retreating old tailings. About 85 percent of the ore was from open-pit operations, the remainder from underground. The company worked no placer ground during the year. Henry V. Plekas prospected the Green Top claim and shipped tungsten ore to a custom mill for treatment. A small quantity of tungsten concentrate was shipped by O. A. Garriott from the Monarch Rand claim. V. T. Bowald pursued development of the Tanana claim and shipped a small tonnage of tungsten ore to a custom mill. Ralston, Garrett & Evans worked the Pioneer group of claims and shipped gold ore containing silver to a custom cyanide mill. This district also lies in Kern County.

Signal District.—Joe Larrieu made a small shipment of gold ore containing silver to a smelter from the Hackberry (Denver) mine. Cunoro Mining Co. operated the J. Juneau claims for a short time in 1954 and shipped lead ore, containing some silver and copper, to a California smelter.

Silver Mountain District.—Riverside Cement Co. operated the Oro Grande portland-cement plant on limestone from the Klondike quarry. The company also quarried shale and sandstone for cement and marketed some limestone for miscellaneous uses. Southwestern Portland Cement Co. quarried sandstone and limestone from the Black Mountain quarry for cement manufacture at its Victorville plant. Victorville Lime Rock Co. produced crushed limestone near Victorville, principally for whiting. Minerals Materials Co. produced crushed quartzite near Oro Grande for use as ganister in furnace linings. Also near Victorville, sand and gravel was produced by W. J. Smithson & Son. Minerals Materials Co. produced pyrophyllite from the Victorite mine, and Marter Mining Co. dug kaolin from the company pit.

Whipple Mountain (Monumental) District.—Brown Minerals Co. produced bentonite from the Honey Brown mine near Vidal. Operators who shipped minor tonnages of manganese and manganiferous ore to Government stockpiles follow: Turtle Mountain Mining Co. (Barnett No. 1 and Hilltop No. 1); Harryman & Robison (Manganese King); and Tom and Leland Noblitt (Monarch group). D. R. Harryman

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shipped a small tonnage of copper ore from the Islander group of claims to an Arizona smelter.

San Diego.—Sand and gravel was produced at several localities in the county by the following: California Division of Highways, San Diego County Road Department, and the United States Navy Department and their respective contractors. Contractors for the California Division of Highways also produced granite for riprap at several sites in the county.

Near Oceanside, Crystal Silica Co. prepared sand for glass, concrete, mortar, blast, and filter uses. H. W. Rohl Co., Inc., produced sand and gravel for building construction. Wiley Bros. Rock & Sand produced sand near Vista for paving, and Smith Construction Co. prepared sand and gravel for building construction. Granite for building and monumental stone was produced by: California Cut Stone & Granite, Inc., near Vista, and Escondido Quarries, National Quarries and Valley Granite Co. near Escondido. Pyrophyllite was produced by Pacific Pyrophyllite Products Co. from its mine near Cadiff and by Howard G. Golem from the Four Gee mine near Escondido. Escondido Sand & Gravel Works near Poway and C. R. Guthridge sand plant near Del Mar prepared sand and gravel for building construction. Carl Niemann Truck Co. produced a small tonnage of sand for concrete and mortar.

Sand and gravel was prepared by Nelson & Sloan and H. G. Fenton Material Co. near Otay, as aggregate for building construction. Nelson & Sloan also operated a basalt quarry at Otay and crushed the material for aggregate. Near Chula Vista, Pioneer Pyrophyllite operated a quarry and crushed feldspar and silica rock for roofing granules and poultry grit; Western Salt Co. recovered salt from sea-water ponds by solar evaporation; Westvaco Mineral Products Division, Food Machinery & Chemical Corp., recovered magnesium chloride, for use in oxychloride cement, from sea-water bitterns; Harborlite Corp. expanded crude perlite for plaster aggregate, and treated pumicite for filter and filler uses at its plant.

In the San Diego area sand and gravel was produced by the following: American Sand Co., Canyon Rock Co., Caudell & Johnson, Daley Corp., Denton Sand Plant, H. G. Fenton Material Co., Mission Sand Plant, and Woodward Sand Co. C. R. Guthridge sand plant prepared ground sand near Del Mar for foundry use, M. H. Golden Construction Co. produced crushed granite for road construction, and Canyon Rock Co. operated a basalt quarry and crushed the material for riprap and aggregates. Union Brick Co. produced miscellaneous clay for brick manufacture.

Those active in tungsten mining included: Joseph Cruz (Jacumba Claim), Ken Berkstresser (Gloria Y. Claim), and Desert Star Mining (Desert Star mine), *Julian (Banner) district*; L. B. Spaulding (Crown Point and Metal Mountain mines), in the La Posta and George W. Wright (Miss Katherine Claims) near San Ysidro. Also in the Julian (Banner) district, gold and silver were recovered from gold ore amalgamated at the Golden Chariot claim by Stanley Kotovol. George A. Ashley marketed kunzite, a gem stone, produced near Pala. Sand and gravel was produced near Santee by El Cajon Sand & Gravel and Monarch Materials Co., for building construction, and structural and paving sands were prepared at Arnell's Sand Plant near

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Lakeside. Pan Chemical Co. produced 12 tons of crude celestite from Fish Creek Mountain. The material was sold to a chemical company.

San Francisco.—The Commercial Minerals Co. ground soapstone and talc, mined elsewhere in the State, at its custom grinding plant at San Francisco.

San Joaquin.—Natural gas was produced in the Galt, Lodi, McDonald Island, Tracy, Thornton, Vernalis, and Roberts Islands fields. The Thornton field extends into Sacramento County. Sand and gravel was produced by the San Joaquin County Highway Department and contractors for the United States Navy Department from several deposits in the county.

Putnam Sand & Gravel Co., Inc., prepared sand and gravel for aggregate near Riverbank. Sand and gravel was prepared near Lyoth by Pacific Coast Aggregates, Inc., at its Kerlinger No. 114 plant; and by A. Teichart & Son, Inc., at the Tracy Rock & Gravel Co. plant near Tracy. Sand and gravel was prepared near Clements by A. B. Warner, Claude C. Wood Co., and Rice Bros., Inc. Heavy clay products were manufactured by Stockton Brick & Tile Co. from miscellaneous clay produced near Stockton.

Ladd-Buckeye District.—Teekay Mines, Inc., operated the Ladd mine and produced manganese ore. Most of the ore was treated at the company concentrating plant near Tracy, which was equipped with a gravity-magnetic milling circuit. The mill products were a battery-grade concentrate that was shipped to a battery plant and a manganese concentrate that was consigned to a Government stockpile. In addition, some of the manganese ore was shipped to a Government stockpile.

San Luis Obispo.—Petroleum, natural gas, and natural-gas liquids were important items in the county mineral output. Petroleum and natural gas were produced at the Morales, Russell Ranch, and Taylor Canyon fields. The Arroya Grande field yielded petroleum. Richfield Oil Corp. prepared natural gasoline and LP-gases at the Russell Ranch field, which also lies in Santa Barbara County.

L. A. Briscoe produced sand and gravel near Arroyo Grande as aggregate for paving. Guiton Foundry Supply prepared sands near Oceano for molding, blast, and engine uses and produced sand and gravel for aggregate. Ray G. Brown contracted for the mining of chromite ore from the Machado open-pit mine and treated appreciable tonnages of the ore in his gravity plant. The chromite concentrate was shipped to the Grants Pass, Oreg., Government Purchase Depot. Walter Warren shipped a small tonnage of manganese ore from the Warren claim near Cambria. Frank Vollmer recovered mercury from 15 tons of cinnabar ore taken from the Oceanic mine.

In the Lime Mountain area, Eaton & Smith crushed limestone from the former Henry C. Dalessi property for road surfacing and other uses. Near Pine Mountain Bill Ellis & Herbert Flannery recovered mercury from ore taken from the Keystone open-pit underground mine.

Walter B. Roselip Co. prepared sand and gravel for building construction near Atascadero. Morro Rock & Sand Co. produced sand and gravel as aggregate for paving near San Simeon. Shandon Gypsum Co. near Shandon and Superior Gypsum Co. at Carriso

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Plain produced agricultural gypsum. Sand and gravel was produced by the California Division of Highways and its contractors and by the San Luis Obispo County Highway Department from various deposits in the county. Crushed limestone was produced by San Luis Obispo County for road construction at several sites in the county.

Adelaida (Adelaide) District.—Fitzhugh & Osborn Mining Co. and W. Osborn & Wm. Stephenson recovered mercury from an appreciable tonnage of ore, which was treated in a 15- to 20-ton-a-day rotary furnace. Other producers of mercury were K. R. Nutting Co., operating the Buena Vista mine, and E. Dodd, who retorted a small tonnage of ore from the Klau mine. Eton & Smith produced sand and gravel.

San Luis District.—Vernon E. James operated the Froom Ranch mine and a gravity mill and shipped chromite ore and concentrate to the Grants Pass, Oreg., Government Purchase Depot.

Santa Marguerita (Rinconada) District.—Albert L. Chaney & George Bell treated an appreciable tonnage of mercury ore from the Rinconada mine in a 50-ton-a-day rotary furnace and produced mercury.

Santa Lucia District.—Castro Mining Co., the largest producer of chromite in California in 1954, operated the Castro open-pit mine (by contract) and treated the ore (by agreement) at the International Metallurgical Chrome Corp. mill near Morro Bay. This corporation operated the Norcross open-pit mine and treated appreciable quantities of company chromite ore at its gravity plant, in addition to ore treated under contract. Pierce Bros., the third largest chromite producer in the State, worked the Hard Face group of claims by open pits and treated the ore by gravity methods. San Luis Mining Co. shipped substantial quantities of chromite concentrate produced from chromite ore, mined at the Seeley-Miller open pit and treated in the company gravity mill. Ruda & Negranti worked the Sweetwater open pit and produced both direct-shipping and milling chromite ores. The latter material was treated in its gravity-milling plant. Harry J. Stevens mined both milling- and shipping-grade chromite ores from the London open-pit mine, and operated a gravity milling plant. J. Elders produced chromite concentrate from milling-grade ore mined at the Trinidad mine. Harold Biaggini produced a small quantity of chromite ore from the Pick & Shovel mine. All the chromite material shipped from the District was consigned to the Grants Pass, Oreg. Government Purchase Depot. Manganese ore was shipped to Government stockpiles by Peter Silacci and P. L. Jackman & Bob Bianchini from the Johe Ranch and by J. H. Beechman who worked the Welsh claim until the latter part of 1954.

San Mateo.—Contractors for the California Division of Highways produced sand for road construction from several deposits in the county. P. J. Gambetta dredged oystershell along the county line in San Francisco Bay for use as calcium carbonate in poultry feed prepared by the Bay Shell Co. at Alviso, Santa Clara County. Skyline Quarries produced crushed limestone for aggregate from the company pit near Half Moon Bay. J. O. Archibald produced crushed granite for road surfacing, near Pescadero. Near Redwood City, Ideal Cement Co. manufactured portland cement at its Redwood City plant, using a natural-shell-and-clay mixture dredged from San Francisco Bay for raw material and Kaiser Gypsum Co., Inc., manufactured plasterboard from crude gypsum imported from Lower California.

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This company also completed construction of a perlite plant in July 1954 for expanding crude perlite purchased for use in gypsum wallboard. McCammon Wunderlich Co. crushed sandstone for aggregate and other uses.

In the South San Francisco area, Marine Magnesium Products Division, Merck & Co., Inc., produced U. S. P. magnesia, magnesium carbonate, and magnesium hydroxide from raw sea water and calcined dolomite. Sand and gravel was prepared by Pacific Coast Aggregates, Inc., at the Brisbane No. 130 plant and the Junipero Serra No. 132 plant and by Rockaway Quarry, Inc., at Sharp Park. Crushed limestone for aggregate was produced by Marks Materials, Inc., from its open pit near Rockaway Beach. Crushed sandstone was produced by Lowrie Paving Co., Inc., for aggregate and other uses near San Francisco. Bethlehem Pacific Coast Steel Corp. operated open-hearth furnaces and rolling mills at its South San Francisco plant.

Santa Barbara.—Petroleum and natural gas were produced principally from three areas—the Santa Maria Valley, the Cuyama Valley, and the coastal area near Santa Barbara. Plants for the production of natural-gas liquids were operated by the following companies (field locations are in parentheses): Rice Ranch Oil Co. (Orcutt); Richfield Oil Corp. (South Cuyana); Shell Oil Co. (Capitan and Santa Maria); Signal Oil & Gas Co. (Elwood); Union Oil Co. of California (Orcutt and Santa Maria). At Santa Maria petroleum refineries of Douglas Oil Co. of California, Union Oil Co. of California (formerly Sunray Oil Co.), and Western Asphalt & Refining Co. had a combined daily crude-oil throughput capacity of 7,000 barrels at the close of 1954 compared with 10,000 barrels as of January 1, 1954. The Forest Service prepared gravel noncommercially for road construction. Sand and gravel was produced by the California Division of Highways, and by the city of Lompoc, and their respective contractors, from various deposits in the county.

Harry L. Roberts shipped chromite ore and concentrate from the Cachuma mine. Cachuma Mining Co. operated the Corrales underground mine and shipped chromite ore and a small tonnage of chromite concentrate recovered by flotation.

In the Lompoc area, Valley Rock & Sand Co. prepared sand and gravel for use as aggregate in building and other construction. Also near Lompo, Great Lakes Carbon Corp., and Johns-Manville Products Corp. prepared diatomite produced from the respective company mines to be sold principally for use in filters and insulation material. Miscellaneous clay was produced by McNeil Building Materials near Santa Barbara. At Casmalia, Airox Co. quarried and expanded a diatomaceous shale containing bituminous material, which was used for lightweight aggregate; this company also mined miscellaneous clay from its pit at Casmalia. Near Santa Maria, H. G. Iliff prepared sand and gravel for use in concrete and mortar; the Southern Pacific Milling Co. prepared sand and gravel for use as aggregate in building and construction; and G. Antolini & Sons quarried limestone for building stone. Buell Flat Rock Co. prepared sand and gravel near Santa Ynez as aggregate for paving.

Santa Clara.—The county of Santa Clara produced crushed limestone for riprap and road construction. P. J. Gambetta dredged

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oystershell at different localities along San Francisco Bay for use as calcium carbonate in poultry feed prepared by the Bay Shell Co. at Alviso. Contractors for Government agencies produced sand and gravel for road construction from several deposits in the county. A small quantity of petroleum was produced at the Moody Gulch field near the Santa Cruz County border.

Near Gilroy, Thomas Maher produced a small tonnage of miscellaneous clay, and sand and gravel was produced by Brems Gravel & Sand and Western Tile & Supply Co.

Permanente Co. operated the largest portland-cement plant in the State near Permanente. The company quarried limestone, sandstone, and a part of its clay requirements for the cement raw materials. Limestone was produced by Bahr & Ledoyen, Inc., from the Page Mill quarry near Palo Alto. Miscellaneous stone was produced by Sondgroth Bros. near Los Altos and by A. F. Voss near Cupertino.

Miscellaneous clay was dug at San Jose by Gladding Bros. Mfg. Co. and Remillard-Dandini Co. for heavy-clay-products manufacture. Sand and gravel were prepared by Western Gravel Co. near Campbell and by A. J. Raisch Paving Co. near San Jose.

Coyote District.—The Palo Alto Mining Corp. treated appreciable tonnages of chromite ore from the O'Connell No. 1 and Tompkin open-pit mines in a gravity plant. Custom ores and ores from company properties in other counties were also treated in the plant.

Los Gatos District.—Miscellaneous stone for base rock and aggregate was produced by John Cuffe at the Senator quarry, formerly worked by L. S. Espinosa, and by Mirassou Bros., who operated the Lone Hill quarry. The Los Gatos Sand & Gravel Co. prepared sand and gravel for aggregate in building construction.

New Almaden District.—Dump ore from several New Almaden claims, including the Senator and the Enriquetta, was retorted by numerous leasees who produced mercury. Arthur S. Burrell, W. L. MacKinnon and others, worked the Guadalupe mine by open-pit methods and retorted substantial tonnages of material, which yielded mercury.

Red Mountain (Phoenix) District.—James McPeters produced magnesite ore from the Western mine near Livermore and shipped the material to an Alameda County grinding plant.

Santa Cruz.—Contractors for the California Division of Highway Contractors, and the Santa Cruz Highway Department produced sand and gravel for road construction from several deposits in the county. The county of Santa Cruz quarried granite for concrete and roadstone in the county.

The Santa Cruz Portland Cement Co. manufactured portland cement at the Davenport plant, using limestone from the Vicente quarry. The company also quarried shale for raw material. By-product potash, which has a market in agricultural areas, was recovered in the plant as precipitated flue dust. Gravel was prepared by Concrete Service Co. at Santa Cruz; by Hansen, Silvey, & Sinnott at Felton (which also quarried granite for concrete and roadstone); and by Victor W. Maddock and United Builders & Farmers Supply at Soquel. Sand and gravel was prepared by Graham & Son at Santa Cruz; and by Henry J. Kaiser Co., Pacific Coast Aggregates, Inc., and Santa Cruz Aggregates Co., all near Felton. The Pacific Lime-

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stone Products Co. produced limestone near Santa Cruz, principally for poultry grit.

Shasta.—The California Division of Highways and its contractors prepared sand and gravel; contractors for the Bureau of Public Roads, the city of Redding, and the Shasta County Highway Department produced gravel; and the Bureau of Reclamation produced basalt for riprap. Volcanic cinder was produced by the California Division of Highways for use on icy pavements at various localities in the county.

Bully Hill District.—The Glidden Co. continued exploration for copper-zinc ore on a DMEA contract at the Bully Hill mine throughout 1954.

Castle Creek-La Moine District.—V. A. Orsini explored the Forest Queen (North Star) group of claims and shipped a small tonnage of chromite ore produced in the course of mine development. Helmke, Thomas & Janssen operated a mill at Castella on chromite ore principally from Butte and Trinity Counties.

Flat Creek District.—The Mountain Copper Co., Ltd., operated the Hornet mine for iron pyrites, used principally for sulfuric-acid manufacture at plants in the San Francisco Bay area. In addition, copper precipitate was recovered from the mine water, and a small tonnage of magnetite ore was produced from surface workings for heavy-aggregate use.

Redding District.—Fredrickson & Watson Construction Co. and Riley Trucking Co. produced gravel for structural and paving use. J. H. Hein Co., Oaks Sand, Gravel & Cement Products Co., and the Redding Sand & Gravel Co. prepared sand and gravel for aggregate in paving and construction. Lassen Lime Products Co. quarried and crushed limestone for agricultural use. Wanda L. & Joseph P. Giles explored the Hummingbird claims and recovered gold and silver from several tons of development ore. A pilot mill was being constructed. Gold and silver were also recovered by Otto Miller who amalgamated a small tonnage of gold ore at the Jumbo mine, and by Roy S. Olson who worked placer tailing and stream gravel on the Oscar O. Davis property, using a dragline excavator.

Shasta District.—Small operations that yielded gold and silver included: E. M. and R. E. Bicking & C. C. Plumb (Little Julio lode claims), James E. Leonard (Whiskey Hill lode mine), and E. L. McDonald (Grubstake placer claim).

Other Districts.—E. A. Forschler produced gold and silver by amalgamating gold ore at the Forschler Ranch in the *Igo district.* Bert Peeler produced sand and gravel at Fall River Mills in the *Lake Britton district.* Keystone Asbestos Corp. continued to explore for chrysotile asbestos on the Trinity group of claims in the *Tamarack district,* which also lies in Trinity County.

Sierra.—The California Division of Highways and its contractors produced sand and gravel for road construction from several deposits in the county. The California Division of Highways also produced crushed granite for road stone.

Alleghany District.—Original Sixteen to One Mine, Inc., the principal mineral producer in Sierra County, worked the Original Sixteen to One gold mine. Gold and silver were recovered by amalgamation and from concentrates shipped to a California smelter. Dickey Exploration Co. operated the Oriental mine and flotation-

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amalgamation mill. Gold and silver were recovered from amalgam and from concentrate shipped to a smelter. Other producers of lode gold included: Harold E. Hawn (Kate Hardy mine); Irelan-Yuba Co., Ltd. (Irelan mine); Yellow Jacket Consolidated Gold Mines, Ltd. (Red Star mine); and C. L. Humphreys (Granite Mountain mine). City of Six Mining Co. did some development at the Gold Channel drift mine and recovered gold and silver from the gravel. A small quantity of placer gold was produced through development work on the Happy Camp drift mine by Agnes J. Gould. The following operators recovered placer gold and silver by small-scale methods: A. C. Farnsworth (Golden Bear claim); Esten Wolden (Hard Work mine); Dick Morrison (Mott claim); and B. J. Lennert (Rainbow claim).

Downieville District.—Best Mines Co., Inc., operated the Brush Creek mine and mill. Gold and silver were produced from amalgam and from flotation concentrate shipped to a custom cyanide mill for further treatment. Luke R. Ram amalgamated a small tonnage of ore from the Chloride mine and recovered gold and silver. J. P. Karl worked the Golden Slide placer mine, a drift-mine operation, and recovered gold and silver. Other operators of placer properties were: Kirkpatrick Mines Co. (Kirpatrick drift mine); Fred Linsea (Magnolia drift mine); and P. D. Vail (Small Fry No. 3 claim).

Pike (Indian Hill) District.—F. Gilman Low & Michael Salonish explored the Alaska (Sierra Alaska) mine and recovered a small quantity of gold and silver from the ore by amalgamation. The Espy Mining Co. operated the Espy placer mine on the Middle Fork of the Yuba River at the Sierra County-Nevada County-boundary.

Poker Flat (Port Wine) District.—Sierra Mining & Development Co. hydraulicked the Pioneer (Wildrose) placer mine and recovered gold and silver from the gravel.

Siskiyou.—Crushed basalt and volcanic cinder were produced by the Siskiyou County Road Department. Sand and gravel was prepared by the California Division of Highways and the Bureau of Public Roads and their respective contractors. Road gravel was produced by Forest Service.

Near Tionesta, pumice was produced by John Madsen from the Skoria Star quarry and by Thompson Pumice Co. from the Thompson quarry for concrete aggregate, and near Tulelake by U. S. Pumice Supply Co., Inc., from the Glass Mountain quarry. The pumice from the latter quarry was sized at the Tulelake mill in Modoc County. Volcanic cinder was produced for railroad ballast by the Southern Pacific Co. from the Kegg quarry near Bray and by the McCloud River Lumber Co. from the Porcupine pit near Hambone.

Near Mount Shasta, the Mount Shasta Gravel Co. prepared sand and gravel as aggregate for building construction. Mount Shasta Mining Co. produced a small quantity of chrysotile from the company stockpile and shipped the material to a Los Angeles plant. The Keystone Asbestos Corp. explored its property for chrysotile asbestos under a DMEA contract. Work accomplished consisted of diamond drilling the deposit. No asbestos was produced.

Klamath River (Clear Creek-Doe Flat, Seiad) District.—Ruth Robertson, who ranked the fourth highest as a producer of chromite

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ore in the State, operated the Cyclone Gap underground mine and shipped the ore to the Grants Pass, Oreg., Government Purchase Depot. This property was formerly listed in the Preston Peak district. J. R. Hutchinson shipped chromite ore from the Annabell open-pit mine. Ashland Mining Co. mined appreciable tonnages of chromite ore from the Annabell No. 1 and Chrome Mountain No. 1 claims. The ore was upgraded in the company mill at Ashland, Oreg. S. B. Lewis mined and shipped chromite ore from the Emma Bell underground-open pit mine. Wermark & Holloway also worked the Emma Bell property and shipped chromite ore to a custom mill. J. T. Eastlick mined a small quantity of chromite ore from the Charles Tant open-pit mine. Klamath River Chrome Co. was constructing a 50-ton-a-day gravity mill for treatment of the John Ladd mine chromite ore. Siskon Corp. operated the Siskon open-pit mine and cyanide plant, the fifth largest producer of gold in the State. The company treated 25,600 tons of gold ore, grossing 14,700 ounces of gold and 35,000 ounces of silver. Frank Lange recovered a small quantity of gold from gravel at the White Oak claim.

Salmon River (Cecilville) District.—Chromite ore was produced and shipped by Francis George from the Black Hawk claim and by David H. & Thomas H. George from the Little Herbie claim. Alex Markon worked the Annie Johnson mine and recovered gold and silver from the ore by amalgamation.

Scott River District.—Chromite ore was shipped to the Grants Pass, Oreg., Government Purchase Depot by the following operators: Lewis Foreman, Ted Wallace & L. W. Loofborrow (Big shot claim); George Harrison & C. W. Birdwell (Black Bear claims); J. S. Hayden (Jump Around claims); Jess Fowler & Shirley Baker (Lone Cedar claim); Floyd L. Munson (Munson open-pit mine); Basil Wild (Rocky Gulch claim); Carver Gepford (Sugar Pine prospect); and George Milne (Wolfe claim). The Ashland Mining Co. shipped chromite ore from the Lady Grey, Octopus, and H. Tompkin open-pit mines to its Ashland, Oreg., mill for upgrading. J. H. Watkins also mined and milled chromite ore from the Octopus and Lady Grey mines. Frank Cory explored the Green Dragon No. 1 claim and produced a small tonnage of lead ore containing silver, which was shipped to a California smelter. Gold and silver were recovered by G. A. Reichman from the ore amalgamated at the Cherry Hill mine and from ore shipped by Virgil Rodgers from the Forest King claims to a California smelter. Placer properties that yielded gold and silver included the A. B. C. claims under development by Alexis A. Bouvier and the DeFaria Ranch worked by E. W. & J. Kramer and M. C. & Joe DeFaria, who used mechanical excavators. Keystone Asbestos Corp. continued to explore the Calethia claims for crysotile asbestos under a DMEA contract.

Shasta River (Yreka) (Gazelle) District.—Chromite ore was shipped to the Grants Pass, Oreg., Government Purchase Depot by the following operators: Charles Page (Blue Jay Open Pit mine); G. B. Sappington (Cameron Sappington claims); J. A. Richter (Gazelle Mountain Masterson open pit-underground mine); J. T. Eastlich (Masterson mine); Ernest A. Hayden (Mule Shoe open pit-underground mine); Rough Mountain Mining Co. (Rough Mountain-Moffett Creek mine); and H. L. Shasta & Ross Johnson (Section 31

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open-pit mine). Gold and silver were produced by A. G. Fledderman from gravel hydraulicked at the Fledderman mine near Yreka.

Shasta Valley District.—Near Yreka, Manuel M. Silva prepared sand and gravel as aggregate in building construction, and A. Young produced miscellaneous crushed stone for roadstone, railroad ballast, and other uses. Shastalite Cinder Block Co. prepared volcanic cinder near Weed and Yreka as an aggregate for concrete building blocks.

Solano.—Natural gas, the principal item of mineral production in the county, was withdrawn from the Cache Slough, Kirby Hill, Maine Prairie, Miller, Suisun Bay, Winters, and Rio Vista fields. The Rio Vista field also lies in Sacramento and Contra Costa Counties, and the Winters field extends into Yolo County. Fredrickson Bros. produced some crushed miscellaneous stone near Winters for aggregate. Near Rio Vista, Asta Construction Co. prepared sand for paving use, and Delta Construction Co. produced gravel. The Asta property extends into Sacramento County. Contractors of the California Division of Highways crushed gravel for road construction at several sites in the county. Parish Bros., Inc., near Benicia and Cordelia Quarries near Thomasson quarried and crushed basalt for aggregate. Basalt Rock Co. dug bentonitic clay at the Chabot pit near Vallejo for use in making expanded clay.

Sonoma.—The County of Sonoma produced miscellaneous stone for riprap. The California Division of Highways and its contractors produced gravel for road construction from several sites in the county. A small quantity of petroleum was produced in the Petaluma area. Thomas A. Graham produced crushed shale for roadstone, near Occidental.

In the Santa Rosa Area, Arthur B. Siri, Inc., produced crushed basalt and prepared sand and gravel for road construction, and Construction Supply Co. produced crushed shale for road base. Sand and gravel was also prepared by Empire Rock Co., Inc. Gravel for paving was produced by Franklin W. Serres, using a portable plant, near Aqua Caliente, and gravel for building construction was produced at Wrobels gravel pit near Sonoma.

Sand and gravel was prepared by Basalt Rock Co., Inc., Russian River Gravel Co., and Harvey Taylor Gravel Co.; near Healdsburg by Construction Supply Co. near Mirabel; Hein Bros. Basalt Rock Co. near Windsor; and Mirabel Gravel Co. near Forestville.

Crushed basalt for roadstone was produced by Hein Bros. near Petaluma and by Talbert Rock Quarry near Cotati.

Guerneville District.—Sonoma Quicksilver Mines, Inc., second-ranking producer of mercury in California in 1954, worked the Mount Jackson-Great Eastern mine. Two Gould rotary furnaces, 80- and 40-ton-a-day, respectively, were used for treating the ore. Joe Malugani produced crushed shale near Rio Nido for roadstone, and L. T. Willig produced gravel near Jenner for paving use.

West Mayacmas District.—Buckman Mines, Mining Division of Buckman Laboratories, Inc., worked the Buckman mines (included Cloverdale and Culver-Baer) and recovered mercury from ore treated in a Gould-type, 100-ton-a-day rotary furnace and a retort. Baumeister, Hulbert & Muffly also treated ore from the Culver-Baer mine in a 20-ton rotary furnace and produced mercury. Other

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producers of mercury by retorting ore included: W. R. & W. E. Head (Sonoma group of mines) and Forest & Mitchell (Lost Ledge-Mercury Divide mine).

Stanislaus.—Sand and gravel was prepared near Empire by American Sand & Gravel Co.; near Modesto, at the Graystone Tile sand pit and by Modesto Sand & Gravel Co., Inc.; near Hughson, by Hughson Gravel Plant; near Hickman, by Chas. D. Warner & Son, Inc.; and near Waterford, by M. J. Rudd & Son and Sante Fe Rock & Sand Co. Sand and gravel also was produced by Standard Rock Co. near Oakdale and by Frank B. Marks, Jr., near Newman. H. Sykes prepared gravel near Patterson for paving. Clayton & Lester Raggio mined fire clay from the Coopertown pit near Knights Ferry. Contractors for the California Division of Highways produced sand and gravel for road construction at several deposits in the county. Barium Products, Ltd., manufactured barium chemicals at Modesto, treating barite, which was produced outside the State.

Ladd-Buckeye District.—Willis Loveless shipped low-grade manganese-ore fines from the Section 21 tailings dump. Tom & Lester Babb and Winston F. Wright shipped manganese ore, and Nestor M. Noe & Irven Van Sickle shipped manganiferous concentrate from Tip Top mine. This district extends into San Joaquin County.

Red Mountain (Phoenix) District.—E. F. Holmes & Joe Odermatt produced mercury by retorting ore mined from the Adobe claim. This district extends into Santa Clara County.

Sutter.—Gladding, McBean & Co. quarried miscellaneous clay from the company pit near Nicolaus. Hutchinson Co. prepared gravel near Yuba City for paving use. The Sutter County Road Commission produced gravel for road construction from several deposits in the county. Natural gas was withdrawn from the Marysville Buttes field.

Tehama.—The California Division of Highways and its contractors produced sand and gravel and contractors for the Bureau of Public Roads produced gravel at several localities in the county. Natural gas was withdrawn from the Corning fields in 1954. Sand and gravel was prepared near Red Bluff by Allen & Reddy and Red Bluff Sand & Gravel Co.; and by Globe Builders Supply, Inc., near Richfield.

Beegum Creek-Tedoc District.—Beegum Mining Co., successor to Tedoc Mining Co., worked the Blue Sky, Lucky Star, Seagraves, North Fork, River Divide, and Mary Ann claims and shipped chromite ore and concentrates. Stansbury, Inc., leased properties from Tedoc Mining Co. and acquired mining and milling equipment for eventual operation. J. H. McKinnery & Frank Piatt explored and developed the Black Chrome (Lucky group) claims by a shaft. A small tonnage of chromite ore was shipped. Joseph Cerney & Perry Magee explored the Bear Cat claim and shipped a small tonnage of chromite ore.

Elder Creek (Kleinsorge) District.—Elder Creek Mining Co. shipped chromite ore from the Elder Creek mine. Metro Metals, Inc., worked State-school land for chromite and shipped substantial tonnages of ore and concentrate.

Trinity.—The California Division of Highways and its contractors produced sand and gravel, and contractors of the Bureau of Public Roads produced gravel for road construction from several deposits in the county.

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Eel River (Forest Glen) District.—K. P. F. & F. Mining Co. worked the Blue Jay mine and shipped manganese ore to Government stockpiles under both the carlot and low-grade stockpile programs.

Hayfork River District.—Dubekella Mining Co. consigned a small tonnage of chromite ore from the Billie Max claim to a custom mill. L. L. Hodges shipped chromite ore from the Chrome claim to the Grants Pass, Oreg., Government Purchase Depot. Lowell Morgan, Lyle A. Smith, George W. Patton, and Liston Ehorn shipped chromite ore from the Chromite No. 1, I Wonder, Little Nellie, and Shamrock claims, respectively. George H. Martin developed the Layman gold mine by opencut. A small tonnage of gold ore was amalgamated, and gold and silver were recovered. Ted Webb & Don Johnson shipped a small tonnage of manganese and manganiferous ores from the Manganese Queen mine to a Government stockpile.

Island Mountain District.—The Northwestern Pacific Railroad Co. quarried miscellaneous stone at Island Mountain for riprap.

Mad River District.—K. P. F. & F. Mining Co. worked the Bonanza mine, and Channel Marine Co. operated the Double A mine. Both operators shipped manganese ore to a Government stockpile.

New River District.—Gordon B. Langworthy amalgamated dump material from the Salmon Summit mine and recovered a small quantity of gold and silver.

Trinity River (Cinnabar) District.—Fairview Placers, the principal mineral producer in Trinity County, operated a Yuba bucketline dredge equipped with seventy-five 10½-cubic-foot buckets at Minersville throughout 1954. Gold and silver were recovered. M. L. Benoist prospected the Chloride Globe group of claims and recovered gold and silver from ore treated by amalgamation. Copper ore was shipped to a smelter from the Rainbow claim operated by J. M. Foster. Clayton L. Kalbaugh recovered gold from the Thursday No. 1 placer claim in the Cinnabar area by hydraulicking, and Bennett Mining Co. worked the Bennett hydraulic mine at Big Bar during the early part of the year and produced gold and silver. Other placer operators were: Teddy Sortori (Betty Placer); E. J. Hostetter (Big Flat claim); David Montgomery (Ho-Hat hydraulic mine); and R. H. O'Malley (Revival claim). The Trinity Sand & Gravel Co. prepared sand and gravel as aggregate for building construction near Douglas City. Helmke, Thomas & Kanssen mined appreciable tonnages of chromite ore at the Cow Creek group of claims and shipped the ore to the company mill at Castella, Shasta County, for upgrading. E. A. Lough shipped a small quantity of chromite ore from the Happy Go Lucky claim. S. F. Baker explored the Biten Bender claim and shipped a small tonnage of chromite ore. C. F. Starr operated the Redskin mine and shipped chromite ore to the Grants Pass, Oreg., Government Purchase Depot. In addition Starr stockpiled milling ore at a custom mill and shipped manganiferous ore from the Spider mine.

Tulare.—Natural gas was withdrawn from the Trico field, which extends into Kern and Kings Counties. Some petroleum was produced in the Deer Creek area. Contractors for the California Division of Highways crushed granite for roadstone. Sand and gravel was produced by contractors for the Kings County Highway Depart-

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ment and the California Division of Highways from several deposits in the county.

In the Cottonwood Creek area, Claude Rouch, Sr. & Jr., produced and concentrated a substantial tonnage of tungsten ore from the Harrel Hill mine. Wheeler Mining Co. worked the Wheeler claim during the first 2 months of 1954 and shipped tungsten ore to a custom mill.

In the Yokohl River area, Tulare County Tungsten Mines treated an appreciable tonnage of tungsten ore from the Big Jim mine in the company mill and shipped concentrate. Custom ore from nearby mines was also treated. Tungsten concentrate from ore produced at the Thanksgiving claim was shipped to an ore buyer by the operator.

In the Kaweah River South Fork area, Buckeye Mining Co. shipped tungsten ore to a custom mill from the Buckeye and Midnight mines. Three Rivers Mining Co. shipped tungsten ore to a custom mill from the Blossom Peak mine. Tungsten concentrate from ore produced at the Pioneer mine was shipped to an ore buyer by the Good Hope Mining Co. In the lower river area, S. P. Brick & Tile Co. manufactured clay products from miscellaneous clay produced near Exeter. Pacific Coast Aggregates, Inc., prepared sand and gravel near Lemon Cove for aggregates in building construction. George E. France, Inc., operating a portable plant, produced gravel near Visalia. In the North Fork area, Kaweah Mining & Milling worked the Baker and Homer mines and concentrated the tungsten ore in the company mill. Custom ore also was accepted for treatment. Cougar Mining Co. worked the Hilltop mine until midyear and shipped tungsten ore to a custom mill. Tungsten ore was shipped to a custom mill from the Timberlake claim by the Timberlake mine, and a small quantity of tungsten concentrate was shipped by Stoney Creek Mining Co. from the Stoney Creek claim.

A. Montrose produced a small tonnage of barite while doing development work on his claims near Springville. Middletons-Sequoia Rock Co. prepared sand and gravel near Porterville for use as aggregate in building construction and paving. Hunter Scheelite Co. shipped tungsten ore from the Hunter open-pit mine to a custom mill.

In the Kern River area, Fred W. & Ora L. Bowers shipped 357 tons of tungsten ore to custom mills from the Christmas mine. North Meadow Mining Co., Inc., opened the North Meadow mine, a new operation, and shipped tungsten concentrate to ore buyers. Sherman Peak Mining Co. shipped substantial quantities of tungsten concentrate from the Sherman Peak mine. S. D. Crostenburg developed and explored the Brush Creek tungsten claim. In the South Fork area, Emery L. Bales shipped a small tonnage of tungsten ore from the Great Western mine to a custom mill. This area extends into Kern County.

White River District.—Nolan & Schrader mined and treated tungsten ore from the Nolan & Schrader mine. Custom ore was also treated in its gravity plant.

Tuolumne.—Tuolumne County Road Commission produced crushed basalt for riprap and aggregate and crushed granite and sandstone for roadstone. The California Division of Highways and its contractors produced sand and gravel for road construction from various localities in the county.

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Near Dorothy Lake, Tuolumne Tungsten Co. shipped tungsten ore from the Montezuma mine to a custom mill.

East Belt District.—Gold and silver were recovered from gold ore by amalgamation at the following properties (the operators names are in parentheses): Fenton claims (Orin L. Fenton); Hidden Fortune mine (Harry Gibson); Toughnut mine (F. A. Clements & F. J. Halousek); and Mack claim (Jack S. Piper).

Mother Lode District.—Near Sonora, United States Lime Products Corp. produced hydrated lime and quicklime, principally for use in chemical industries, at the Sonora plant from limestone quarried nearby. Sonora Marble Aggregates Co. quarried and crushed marble of various colors for use in terrazzo and produced some limestone for dimension stone. Sand and gravel was prepared by A. P. Jones-Sierra Sand & Gravel Co. as aggregate for paving. C. D. Bottini produced sand for miscellaneous uses, and Beerman & Sons prepared gravel for paving. H. R. Hollingsworth worked the If I Can drift mine and recovered a small quantity of gold from the gravel. Minor lode-gold operations were worked by the following: Geo. E. Trask, Hidden Treasure mine; R. H. Hollock, Ford claim; and R. M. Kraymer, Brown claim. W. R. Williamson worked the Mums and Rattlesnake properties in the Marsh Flat area and consigned refractory-grade chromite to an ore buyer.

Ventura.—Petroleum, natural gas, and natural-gas liquids were the principal minerals produced in the county in 1954. The yield of mineral fuels was from an area that traverses the central portion of the county from the eastern border westward to the Pacific Ocean. Natural-gasoline plants were operated by the following companies (the field locations are in parentheses): Colina Gasoline Corp. (Rincon-Padre); Continental Oil Co. (San Miguelito); General Petroleum Corp. (Ventura Avenue); The Texas Co. (Shiells Canyon); Tide Water Associated Oil Co. (Ventura); and Union Oil Co. of California (Grimes Canyon). Petroleum refineries of Edington-Oxnard Asphalt Co. and Oxnard Oil & Refinery Co. at Oxnard and those of Superior Asphalt Co. and Seaside Oil Co. at Ventura had a combined daily crude-oil throughput capacity of 8,000 barrels at the close of 1954 compared with 9,000 barrels on January 1, 1954. Contractors for the California Division of Highways produced limestone for riprap, and prepared sand and gravel. Contractors for the United States Navy and the Ventura County Road Department produced sand and gravel for road construction at various sites.

Near Cuyama, Monolith Portland Cement Co. produced crude gypsum at the Quatal Canyon property in Cuyama Valley for use at its Kern County plant as a cement retarder, and Dee Weese Spreaders produced crude gypsum for agricultural use.

Ridgelite Products Co. produced fire clay from the company pit near Frazier Park, Kern County. The Saticoy Rock Co., Inc., produced crushed sandstone for base rock and aggregate and prepared sand and gravel near Saticoy. The Southern Pacific Milling Co. produced sand and gravel from deposits near El Rio, Montalvo, and Santa Paula. Western Lime Products Co. quarried shell from the Tapo Alto deposit near Santa Susana for use as calcium carbonate in fertilizer, mineral food, tile filler, and poultry grit. Near Ventura, Rocklite Products, Inc., expanded shale for lightweight aggregate

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from the company pit. Miscellaneous clay was produced by the Shell Oil Co. for use in rotary-drilling muds. Miller Bros. Truck Co. prepared sand and gravel for use as aggregate in paving and building construction.

Yolo.—Natural gas was withdrawn from the Dunnigan Hills, Fairfield Knolls, Pleasant Creek, Sycamore Slough, and Winters Fields. The Winters field extends into Solano County. Contractors for California Division of Highways and the Yolo County Highway Department produced sand and gravel for road construction from several deposits in the county.

Sand and gravel was prepared by Madison Sand & Gravel Co., near Madison; Pacific Coast Aggregates, Inc., near Yolo; and W. C. Railing, Schwarzgruber & Sons, and A. Teichert & Son, Inc., near Woodland.

Yuba.—Yuba Consolidated Gold Fields Yuba Unit, the leading producer of gold in the State in 1954, operated 5 bucketline dredges equipped with 18-cubic-foot buckets (4 of which pursued deep dredging); 2 dredges with 10-cubic-foot buckets; 1 dredge with 8½-cubic-foot buckets; and 1 dredge with 6-cubic-foot buckets. Platinum was recovered in addition to gold and silver. Byproduct gold was recovered incident to sand and gravel production at the Hallwood, and Rice Bros., Inc., gravel plants. Sand and gravel was also prepared near Marysville by Yuba River Sand Co.

Elmer Paustian explored the Barton Hill drift mine and recovered some gold from the ancient river gravel.

The Yuba County Road Department produced paving gravel. Gladding, McBean & Co. produced miscellaneous clay from the company pit at Wheatland.

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The Mineral Industry of Colorado

By Frank J. Kelly,[1] William H. Kerns,[1] Breck Parker,[1] and Alfred L. Ransome[2]

MINERAL PRODUCTION in Colorado, excluding uranium, increased in value in 1954 for the ninth consecutive year. The $44.6 million advance reflected a 24-percent gain for the fuels group and 22-percent and 6-percent gains, respectively, for the metal and nonmetal commodity groups. Both molybdenum and petroleum made impressive advances in production and value in 1954. Petroleum again established a new record high, largely as the result of continued rapid development of oil fields in the Denver-Julesburg Basin. Coal production was lower in 1954 by 19 percent, whereas other mineral fuels, including natural gas and natural-gas liquids, gained. All of the principal nonmetallic minerals except clays increased in value of production.

Vanadium recovered as a byproduct of uranium was second to molybdenum in value of production. The value of molybdenum produced in Colorado, all at the world-famous Climax mine, composed better than half of the total value of all metals from the State. An average of 27,500 tons of ore per working day was treated at the Climax mill. Byproduct tungsten, pyrite, and tin were recovered from the ore.

Uranium was one of the most important minerals produced in the State, and from 1950 to 1954 uranium exploration, development, mining, and milling literally mushroomed.

Some production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences of coverage.

The combined value of production of gold, silver, copper, lead, and zinc during the year declined 3 percent, compared with a decrease of 38 percent in 1953. The decline reflected small outputs of zinc, lead, and gold, which were not compensated for by gains in production and value for copper and silver.

A continued upward trend in residential, office-building, and highway-construction activity resulted in increased output of most nonmetals.

Cement, sand and gravel, fluorspar, stone, and clays were the principal nonmetal commodities—in that order—all exceeding $1 million in value of production in 1954.

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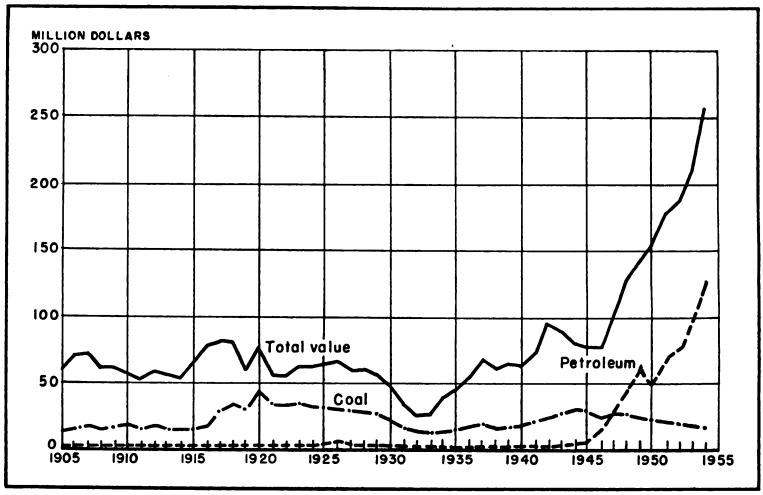

FIGURE 1.—Total value of all minerals produced in Colorado, excluding uranium from 1941–54 and value of coal and petroleum, 1905–54.

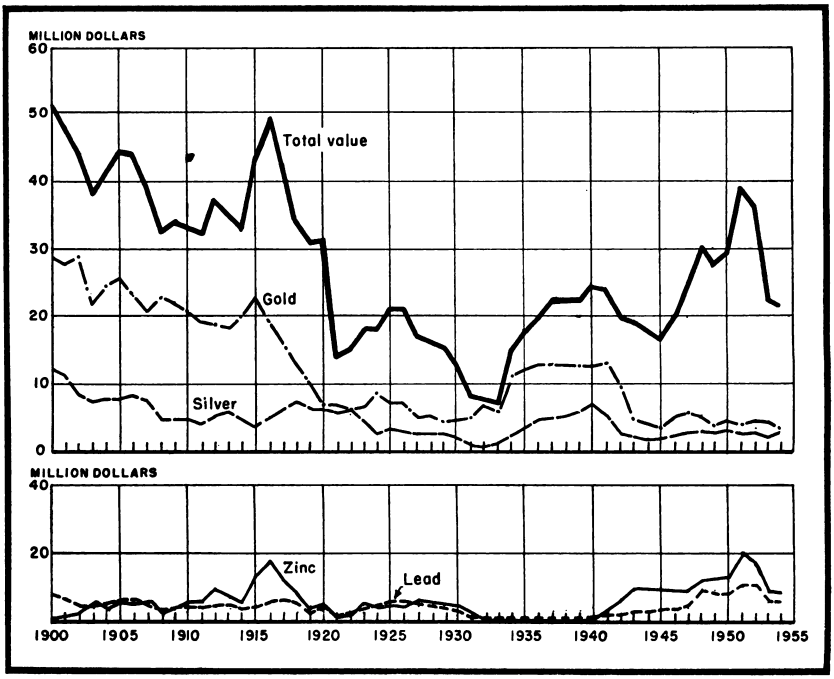

FIGURE 2.—Value of mine production of gold, silver, lead, and zinc and total value of gold, silver, copper, lead, and zinc in Colorado, 1900–54. The value of copper has been less than $2,000,000 annually, except in a few years.

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TABLE 1.—Mineral production in Colorado, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Beryllium concentrate—gross weight	75	[2] $39,515	60	$27,130
Clays	777,969	1,429,780	854,791	1,002,873
Coal	3,574,850	19,197,732	2,899,791	16.078,581
Columbium-tantalum concentrate—pounds, gross weight	[3]	[3]	4,967	9,897
Copper (recoverable content of ores, etc.)	2,941	1,688,134	4,523	2,668,570
Feldspar—long tons	43,508	267,642	[3]	[3]
Fluorspar	53,276	2,872,360	59,197	3,197,252
Gold (recoverable content of ores etc.)—troy ounces	119,218	4,172,630	96,146	3,365,110
Gypsum	62,936	233,043	[3]	[3]
Iron ore (usable)—long tons, gross weight	900	3,825	6,049	[3]
Lead (recoverable content of ores, etc.)	21,754	5,699,548	17,823	4,883,502
Mica (scrap)	1,599	19,455	[3]	[3]
Molybdenum (content of ore and concentrate)—thousand pounds	33,851	[3]	[3]	[3]
Natural gas—million cubic feet	28,509	1,654,000	45,705	3,976,000
Peat	6,067	[3]	9,028	[3]
Petroleum (crude)—thousand 42-gallon barrels	36,402	98,650,000	46,206	127,990,000
Pumice and pumicite	47,919	99,700	[3]	[3]
Sand and gravel	12,438,600	8,609,151	13,552,406	9,026,993
Silver (recoverable content of ores, etc.)—troy ounces	2,200,317	1,991,398	3,417,072	3,092,623
Stone	[2] [4] 884,104	[2] [4] 1,750,726	1,804,004	2,112,093
Tungsten concentrate—60-percent WO_3 basis	817	2,902,490	927	3,420,563
Vanadium (content of ores, etc.)—pounds	7,993,922	[3]	8,516,174	[3]
Zinc (recoverable content of ores, etc.)	37,809	8,696,070	35,150	7,592,400
Undistributed: Carbon dioxide, cement, gem stones, lithium minerals, natural-gas liquids, perlite, pyrites, tin, vermiculite, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		[1] [5] 51,609,066		68,472,718
Total Colorado		[2] 211,586,000		[6] 256,197,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers). Excludes low-grade manganese ore shipped to General Services Administration Purchase Depots and uranium ore.
[2] Revised figure.
[3] Value included with "Undistributed."
[4] Excludes limestone for cement and lime.
[5] Excludes clays used for cement.
[6] The total has been adjusted to eliminate duplication in the value of clays and stone used for cement and lime.

TABLE 2.—Average prices of selected mineral commodities in Colorado, 1953–54 [1]

Commodity	1953	1954
Beryl—short ton	[2] $526.867	$452.167
Clays—do	1.838	1.173
Coal—do	5.369	5.545
Copper [3]—pound	.287	.295
Fluorspar—short ton	53.915	54.010
Gold [4]—troy ounce	35.000	35.000
Gypsum—short ton	3.703	3.912
Lead [3]—pound	.131	.137
Petroleum [5]—42-gallon barrel	2.710	2.770
Sand and gravel—short ton	.692	.666
Silver [6]—troy ounce	.905+	.905+
Stone—short ton	1.980	1.171
Tungsten—short-ton unit contained in 60-percent WO_3 concentrate	59.190	61.473
Zinc [3]—pound	.115	.108

[1] Prices are based on average value f. o. b. mines or mills reported by the producers, except as otherwise noted.
[2] Revised figure.
[3] Yearly average weighted price of all grades of primary metal sold by producers.
[4] Price under authority of Gold Reserve Act of Jan. 31, 1934.
[5] Value at wells.
[6] Treasury buying price for newly mined silver July 1, 1946, to date—$0.9050505 ($0.905 used in 1947 for calculating purposes).

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Many ores contain valuable minor constituents such as arsenic, bismuth, cadmium, cobalt, nickel, platinum-group metals, selenium, tellurium, and some minor metals, such as gallium and germanium. These quantities sometimes are not known and sometimes, though known by analyses, are not accounted for metallurgically in early processing stages or credited to the mine of origin. These minor constituents are recovered at plants, frequently treating mixtures of materials from many sources, including residues from the refining of metals, such as copper, lead, and others, and in other ways. It is not possible in many such instances to distribute the mineral products by States of origin, and in some instances it is even difficult to obtain an accurate separation as to domestic and foreign sources. Another mineral product of value, the production of which usually cannot be separated as to source, is byproduct sulfuric acid.

The American Smelting & Refining Co. continued to operate its Arkansas Valley custom lead bullion-copper matte smelter at Leadville on ores and concentrates from Colorado and domestic and foreign concentrates, residues from zinc smelters, and other material. The company also operated its Globe smelter in Denver, which treated flue dust, dross, and other byproduct material shipped to it from other company smelters for the recovery of cadmium, indium, and thallium.

The Colorado Fuel & Iron Corp. steel mill and new seamless tube mill at Pueblo operated during the year. The plant was a large consumer of limestone, coal, and other raw materials mined in Colorado, and iron ore from company mines in Utah and Wyoming.

It was reported [3] that 12.6 thousand persons were employed in the mining industry in Colorado during 1954. Of this total, 40 percent were employed in metal mining, 19 percent in coal mining, 35 percent in petroleum and natural-gas production, and 6 percent in other mining and quarrying.

DEFENSE MINERALS EXPLORATION PROJECTS

The Government, through the Defense Minerals Exploration Administration (DMEA), continued to aid in financing exploration in search of strategic and critical minerals. Details of projects undertaken in Colorado during 1954 are given in table 3.

REVIEW BY MINERAL COMMODITIES

METALS

Beryllium.—Pegmatite deposits of Colorado worked for beryl, feldspar, columbite-tantalite, and other associated minerals yielded 60 tons of hand-sorted beryllium concentrate in 1954—a 20-percent decrease from 1953. Clear Creek, Fremont, Gunnison, Jefferson, and Larimer were the principal-producing counties. Producers sold beryl to Beryl Ores Co. of Arvada, Colo.; International Minerals & Chemical Corp., Parkdale, Colo.; and the Government Purchase Depot at Custer, S. Dak. The Beryl Ores Co. ground and blended beryl for the ceramic market. Small lots of beryllium compounds

[3] U. S. Department of Labor, Bureau of Labor Statistics.

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TABLE 3.—Defense Minerals Exploration Administration contracts in Colorado in 1954

Contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
Aztec Mining Co	Chipmunk claims	Uranium	Oct. 6, 1954	$6,660	75
Buckskin Joe Mines, Ltd	Gold Ridge, Denver, and France claims	Lead, copper, and zinc.	Dec. 31, 1954	44,875	50
Johnson Bros. & Prime	Hoosier and Phillip lode.	Tungsten	Jan. 18, 1954	38,000	75
J. R. Simplot Co	Peanut group	Uranium	Dec. 21, 1953	98,641	90
Lowell A. Griffiths & Assoc.	Shamrock group	do	Sept. 9, 1954	18,350	75
T. J. and D. A. Mahoney	Adams lode	Tungsten	Mar. 1, 1954	19,200	75
Lloyd P. Mock	Big Six mine	do	Jan. 4, 1954	8,901	75
Ray Ryan	Nora L claims	Uranium	Oct. 7, 1954	66,939	75
San Juan Uranium Corp	Goodhope unpatented.	do	Sept. 13, 1954	10,500	75
George D. Schweigert	GW and Antrim lode.	Thorium, rare earths, and uranium.	Jan. 4, 1954	2,887	90
J. L. Starnes	Poopout mine	Tungsten	Aug. 20, 1954	14,000	75
United States Uranium	Red Hill claims	Uranium	Dec. 13, 1954	31,683	75
Harold and Tommy Williams.	Gale mine	Tungsten	Dec. 20, 1954	13,400	75
Total				374,036	76

were prepared by the company to fill orders. The Government domestic beryl-purchase program continued in force. The prices paid were $40 a unit for ore containing 8.0–8.9 percent BeO; $45 for 9.0–9.9 percent; and $50 for 10 percent or over.

Cadmium, Indium, and Thallium.—The Globe smelter of the American Smelting & Refining Co. in Denver recovered cadmium, indium, and thallium from flue dust, dross, and other byproduct material shipped to it from other company smelters in 1954.

Columbium and Tantalum.—Most beryl producers also recovered columbium-tantalum concentrate as a coproduct and sold it to Beryl Ores Co., Arvada, Colo., or the General Services Administration Purchase Depot at Custer, S. Dak. Lots of concentrate of less than 1 ton containing a minimum of 50 percent combined columbium and tantalum pentoxide were purchased at a flat rate of $1.70 a pound of ore or concentrate under the Government purchase program.

Copper.—The copper produced in Colorado in 1954 (4,523 short tons) was 54 percent above 1953 (2,941 tons). Most of the rise came from an increased output of copper by the New Jersey Zinc Co. from the Eagle mine in the Battle Mountain district of Eagle County. This increase resulted from a fivefold gain in the quantity of silver ore mined by the company from which copper, in addition to gold, silver, and lead, was recovered by direct smelting. The remainder of the copper output was recovered from complex ores of gold, silver, copper, lead, and zinc; only 9.5 tons of copper came from straight copper ore.

The Idarado Mining Co. was again a substantial producer of copper in the State in 1954. The copper was recovered from concentrate produced from copper-lead-zinc ore mined from the Treasury Tunnel-Black Bear group of mines in San Miguel County. Fourteen counties other than Eagle and San Miguel produced copper. Copper was

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recovered in approximately equal quantities by concentration and subsequent smelting of the concentrate and by direct smelting of ore and cleanup material.

Gold.—Colorado gold production declined again in 1954, as it did in 1953. The 1954 output was 19 percent below that in 1953. Lode mines furnished 98 percent of the total quantity of gold produced; 19 mines classed as placer mines accounted for the remaining 2 percent of the total gold output. Continued adverse economic conditions for the straight gold or gold-silver miner, due to the fixed price of gold coupled with rising wages and cost of materials and supplies, and transportation rates, were responsible for the drop in gold output. Many producers were able to continue operations by selective mining or increased mechanization to reduce operating costs.

Teller, San Miguel, Eagle, and Lake were, in order of value of output, the leading gold-producing counties in Colorado in 1954. The Cripple Creek district of Teller County, producing straight gold ore, contributed 51 percent of the State total gold in 1954 (43 percent in 1953). The Golden Cycle Corp. operating the Ajax group of mines in the Cripple Creek district was the leading producer of gold in Colorado in 1954. The gold recovered from copper-lead-zinc ore mined from the Treasury Tunnel-Black Bear group of mines by Idarado Mining Co. accounted for a large part of the gold output from San Miguel County. The New Jersey Zinc Co. Eagle mine and the Resurrection Mining Co. Resurrection group of mines were the leading producers in Eagle and Lake Counties, respectively, and accounted for most of the gold produced in each county.

TABLE 4.—Mine production of gold, silver, copper, lead, and zinc, 1945–49 (average), 1950–54, and total, 1858–1954, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945–49 (average)	249	30	1,413,243	133,849	$4,684,729	2,586,096	$2,210,668
1950	202	30	1,372,744	130,390	4,563,650	3,492,278	3,160,688
1951	196	21	1,578,466	116,503	4,077,605	2,787,882	2,523,174
1952	171	20	1,548,815	124,594	4,360,790	2,813,643	2,546,489
1953	113	19	1,204,517	119,218	4,172,630	2,200,317	1,991,398
1954	123	19	973,177	96,146	3,365,110	3,417,072	3,092,623
1858–1954			[3]	40,070,493	896,344,219	753,601,420	588,544,308

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	2,018	$763,272	20,954	$5,903,321	40,706	$10,053,583	$23,615,573
1950	3,141	1,306,656	27,007	7,291,890	45,776	13,000,384	29,323,268
1951	3,212	1,554,608	30,336	10,496,256	55,714	20,279,896	38,931,539
1952	3,606	1,745,304	30,066	9,681,252	53,203	17,663,396	35,997,231
1953	2,941	1,688,134	21,754	5,699,548	37,809	8,696,070	22,247,780
1954	4,523	2,668,570	17,823	4,883,502	35,150	7,592,400	21,602,205
1858–1954	274,985	78,095,755	2,659,560	299,835,501	1,698,462	303,712,792	2,166,532,575

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore, old slag or tailings shipped to smelters during the calendar year indicated.
[2] Does not include gravel washed.
[3] Figure not available.

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TABLE 5.—Mine production of gold, silver, copper, lead, and zinc in 1954, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	10,096	238,467	313	1,596	2,835
February	8,670	280,069	345	1,604	2,590
March	7,911	252,287	353	1,509	2,932
April	8,631	323,397	450	1,350	2,727
May	8,295	405,307	429	1,277	2,550
June	7,759	296,075	382	1,343	2,689
July	6,880	265,260	325	1,480	3,054
August	8,693	296,046	372	1,730	3,052
September	8,140	314,150	384	1,430	3,152
October	6,825	229,605	387	1,481	3,069
November	7,150	256,716	390	1,551	3,143
December	7,096	259,703	393	1,472	3,357
Total	96,146	3,417,072	4,523	17,823	35,150

TABLE 6.—Gold and silver produced at placer mines, 1945–49 (average) and 1950–54, in fine ounces, in terms of recoverable metals

Year	Small-scale hand methods [1]		Hydraulic		Gravel mechanically handled				Total	
					Nonfloating washing plants [2]		Bucketline and dragline dredges			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1945–49 (average)	144	33	10	2	765	123	13,488	2,673	14,407	2,831
1950	83	21			1,246	196	18,084	3,522	19,413	3,739
1951	30	7			(3)	(3)	[3] 13,563	[3] 2,288	13,593	2,295
1952	28	7			(3)	(3)	[3] 2,152	[3] 338	2,180	345
1953	37	11			1,046	159	546	75	1,629	245
1954	79	16			1,112	163	364	47	1,555	226

[1] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, rockers, dry washers, etc.
[2] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."
[3] Production by nonfloating washing plants included with that by bucketline dredges; Bureau of Mines not at liberty to publish separately.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties, in terms of recoverable metals

County	Mines producing		Material sold or treated (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
Adams		7		1,089	$38,115	154	$139
Boulder	4	1	176	196	6,860	4,476	4,051
Chaffee	5		165	20	700	750	679
Clear Creek	9		5,374	1,035	36,225	34,955	31,636
Custer	2		4,227	110	3,850	1,064	963
Dolores	3		41,876	147	5,145	118,621	107,358
Eagle	2		293,878	10,121	354,235	2,111,786	1,911,273
Fremont	1		24	2	70	27	24
Gilpin	7	2	2,822	319	11,165	4,498	4,071
Gunnison	6		567	62	2,170	5,150	4,661
Hinsdale	3		42	10	350	326	295
Jefferson		4		290	10,150	42	38
Lake	10		54,385	5,438	190,330	137,557	124,496
La Plata	1		113	558	19,530	428	387
Mineral	7		45,399	1,964	68,740	238,685	216,022
Montrose	1	1	120	8	280	213	193
Ouray	5		54,734	2,688	94,080	68,249	61,769
Park	4	1	1,067	509	17,815	3,927	3,554
Pitkin	2		10	1	35	110	100
Rio Grande	1		24	19	665	7	6
Routt	2		48			24	22
Saguache	5		378	4	140	2,938	2,659
San Juan	7		6,900	491	17,185	20,395	18,459
San Miguel	4	1	312,158	21,694	759,290	611,808	553,717
Summit	11	2	14,814	436	15,260	43,847	39,684
Teller	22		133,876	48,935	1,712,725	7,035	6,367
Total: 1954	124	19	973,177	96,146	3,365,110	3,417,072	3,092,623
1953	118	19	1,204,517	119,218	4,172,630	2,200,317	1,991,398

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TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties, in terms of recoverable metals—Continued

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Adams							$38,254
Boulder	6	$3,540	59	$16,166			30,617
Chaffee			16	4,384	12	$2,592	8,355
Clear Creek	13	7,670	107	29,318	5	1,080	105,929
Custer			4	1,096			5,909
Dolores	11	6,490	2,177	596,498	2,896	625,536	1,341,027
Eagle	2,355	1,389,450	2,588	709,112	18,604	4,018,464	8,382,534
Fremont	2	1,180					1,274
Gilpin	4	2,360	37	10,138	17	3,672	31,406
Gunnison			74	20,276			27,107
Hinsdale			4	1,096			1,741
Jefferson							10,188
Lake	40	23,600	1,935	530,190	2,437	526,392	1,395,008
La Plata							19,917
Mineral	25	14,750	2,178	596,772	1,111	239,976	1,136,260
Montrose	5	2,950					3,423
Ouray	250	147,500	1,131	309,894	712	153,792	767,035
Park	5	2,950	18	4,932	99	21,384	50,635
Pitkin			2	548			683
Rio Grande							671
Routt	1	590					612
Saguache	1	590	70	19,180	9	1,944	24,513
San Juan	12	7,080	229	62,746	83	17,928	123,398
San Miguel	1,777	1,048,430	6,103	1,672,222	7,966	1,720,656	5,754,315
Summit	16	9,440	1,091	298,934	1,199	258,984	622,302
Teller							1,719,092
Total: 1954	4,523	2,668,570	17,823	4,883,502	35,150	7,592,400	21,602,205
1953	2,941	1,688,134	21,754	5,699,548	37,809	8,696,070	22,247,780

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1954, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines[1]	Material sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore:							
Dry gold	35	137,543	50,636	11,179	8,200	12,300	
Dry gold-silver	6	2,216	310	12,588	16,800	60,880	
Dry silver	6	95,455	9,293	1,885,269	4,382,500	782,900	
Total	47	235,214	60,239	1,909,036	4,407,500	856,080	
Copper	6	213	27	439	19,100	1,400	
Lead	45	31,602	1,128	135,709	62,090	3,219,780	139,900
Lead-zinc[2]	28	490,615	30,918	1,094,868	4,199,360	26,537,180	32,184,300
Zinc	3	200,047	1,279	249,095	336,900	4,454,000	37,406,300
Total	77	722,477	33,352	1,480,111	4,617,450	34,212,360	69,730,500
Other "lode" material:							
Assay sweeps		[3]	138				
Cleanup (lead)		13	3	159	300	2,400	
Old tailings[4]		12,052	680	14,772	9,900	411,700	486,800
Old slag and mill cleanings[5]		3,421	179	12,768	10,850	163,460	82,700
Total		15,486	1,000	27,699	21,050	577,560	569,500
Total "lode" material	124	973,177	94,591	3,416,846	9,046,000	35,646,000	70,300,000
Gravel (placer operations)	19		1,555	226			
Total, all sources	143	973,177	96,146	3,417,072	9,046,000	35,646,000	70,300,000

[1] Detail will not add to totals because some mines produce more than 1 class of ore.
[2] Includes copper-lead-zinc ore, for which the Bureau of Mines is not at liberty to publish separate figures.
[3] Less than 1 ton.
[4] Gold, 4,200 tons; lead-zinc, 7,852 tons.
[5] Old slag: Lead, 3,183 tons. Mill cleanings: Gold, 16 tons; lead, 139 tons; zinc, 83 tons.

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TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery and types of material processed, in terms of recoverable metals

Types of material processed and method of recovery	Material treated (short tons)	Recoverable metals				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:						
Amalgamation:						
Ore	[1]	9,863	3,763			
Mill cleanup	16	7				
Old tailings	[1]	241	240			
Total	[1]	10,111	4,003			
Cyanidation:						
Ore	134,035	48,598	6,733			
Old tailings	4,200	109	600			
Assay sweeps	[2]	138				
Total	138,235	48,845	7,333			
Total recoverable in bullion	138,235	58,956	11,336			
Concentration, and smelting of concentrates [3]	730,404	24,881	1,439,448	4,630,100	33,289,700	70,217,300
Direct smelting:						
Ore	101,104	10,579	1,953,135	4,404,750	2,190,440	
Old slag, etc. [4]	3,418	175	12,927	11,150	165,860	82,700
Total	104,522	10,754	1,966,062	4,415,900	2,356,300	82,700
Placer	[5]	1,555	226			
Grand total	[6] 973,177	96,146	3,417,072	9,046,000	35,646,000	70,300,000

[1] Not available; part of the material amalgamated was a hutch product from jigs in ball-mill-classifier circuits used in some flotation mills.
[2] Less than 1 ton.
[3] Ore: 722,552 short tons; lead-zinc tailings: 7,852 short tons.
[4] Includes lead-mill cleanup, lead cleanup, and zinc-mill cleanup.
[5] Not available.
[6] Excluding placer gravel.

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals

A. For material treated at mills

	Material treated (short tons)	Recoverable in bullion		Concentrate shipped to smelters [1] and recoverable metals					
		Gold (fine ounces)	Silver (fine ounces)	Concentrate (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Boulder	159	48		[2] 409	69	4,411	11,900	117,300	
Chaffee	121	7	3	43	13	266		18,500	24,000
Clear Creek	5,344	611	195	463	423	30,698	26,000	206,800	10,000
Custer	4,200	109	600						
Dolores	41,876	30	8	9,151	117	118,613	22,000	4,354,000	5,792,000
Eagle	199,060			48,084	829	245,647	328,000	4,426,000	37,208,000
Gilpin	2,821	1	2	285	311	4,483	8,000	74,000	34,000
Gunnison	300	37	25	8	22	140		400	
Lake	50,146	2,048	1,285	9,211	3,066	106,364	79,100	3,622,200	4,874,000
Mineral	41,351			5,287	1,629	196,540	50,000	3,391,000	2,222,000
Ouray	54,640			4,184	2,683	66,997	496,800	2,226,000	1,424,000
Park	1,012	149	38	248	299	3,419	8,900	29,300	198,000
Rio Grande	16	7							
Saguache	206	1	8	66	2	1,041	500	37,800	18,000
San Juan	6,683	2	1	559	352	16,547	13,550	417,700	83,300
San Miguel	312,151	7,217	2,438	32,648	14,473	609,215	3,553,850	12,202,300	15,932,000
Summit	14,693	1		4,132	346	34,765	31,500	2,166,400	2,398,000
Teller	133,876	48,688	6,733	67	247	302			
Total: 1954	868,655	58,956	11,336	114,845	24,881	1,439,448	4,630,100	33,289,700	70,217,300
1953	1,175,899	71,827	18,407	125,671	42,040	1,677,110	5,031,790	41,943,640	75,618,000

See footnotes at end of table.

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TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals—Continued

A. For material treated at mills—Continued

	Material treated (short tons)	Recoverable in bullion		Concentrate shipped to smelters [1] and recoverable metals					
		Gold (fine ounces)	Silver (fine ounces)	Concentrate (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY CLASSES OF MATERIAL TREATED									
Dry gold:									
Ore	137,299	49,276	6,952	279	668	3,128	7,400	9,300	
Old tailings	4,200	109	600						
Mill cleanup	16	7							
Assay sweeps	[3]	138							
Dry gold-silver	1,937			184	165	5,832	16,000	50,800	
Dry silver	28			4	1	604	200	700	
Lead	26,661			2,571	705	75,533	60,340	1,826,020	139,900
Lead-zinc: [4]									
Ore	490,615	9,035	3,506	62,561	21,883	1,091,362	4,199,360	26,537,180	32,184,300
Old tailings	7,852	241	240	917	330	13,932	9,900	411,700	486,800
Zinc	200,047	150	38	48,329	1,129	249,057	336,900	4,454,000	37,406,300
Total: 1954	868,655	58,956	11,336	114,845	24,881	1,439,448	4,630,100	33,289,700	70,217,300
BY CLASSES OF CONCENTRATE SHIPPED TO SMELTERS [1]									
Dry gold				190	454	1,644	550	2,200	
Copper				7,107	5,419	107,482	2,766,550	283,400	150,000
Copper-lead				191	156	6,548	30,600	46,600	1,900
Lead				30,490	17,238	1,209,206	1,376,260	31,482,130	
Total to copper and lead plants				37,978	23,267	1,324,880	4,173,960	31,816,330	151,900
Zinc concentrates to zinc plants				76,867	1,614	114,568	456,140	1,473,370	70,065,400
Total: 1954				114,845	24,881	1,439,448	4,630,100	33,289,700	70,217,300
1953				125,671	42,040	1,677,110	5,031,790	41,943,640	75,618,000

B. For material shipped directly to smelters

	Material shipped (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Boulder	17	31	60	100	700	
Chaffee	44		481		13,500	
Clear Creek	30	1	4,062		7,200	
Custer	27	1	464		8,000	
Eagle	94,818	9,292	1,866,139	4,382,000	750,000	
Fremont	24	2	27	4,000		
Gilpin	1	3	12			
Gunnison	267	3	4,985		147,600	
Hinsdale	42	10	326		8,000	
Lake	4,239	324	29,908	900	247,800	
La Plata	113	558	428			
Mineral	4,048	335	42,145		965,000	
Montrose	120	2	211	10,000		
Ouray	94	5	1,252	3,200	36,000	
Park	55	12	461	1,100	6,700	
Pitkin	10	1	110		4,000	
Rio Grande	8	12	7			
Routt	48		24	2,000		
Sagauche	172	1	1,889	1,500	102,200	
San Juan	217	137	3,847	10,450	40,300	82,700
San Miguel	7	3	155	150	3,700	
Summit	121	21	9,069	500	15,600	
Total: 1954	104,522	10,754	1,966,062	4,415,900	2,356,300	82,700
1953	28,618	3,722	504,555	850,210	1,564,360	

See footnotes at end of table.

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TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals—Continued

B. For material shipped directly to smelters—Continued

	Material shipped (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY CLASSES OF MATERIAL						
Dry gold	244	692	1,099	800	3,000	
Dry gold-silver	279	145	6,756	800	10,080	
Dry silver	95,427	9,292	1,884,665	4,382,300	782,200	
Copper	213	27	439	19,100	1,400	
Lead:						
Ore	4,941	423	60,176	1,750	1,393,760	
Mill cleanup	139	117	3,617	6,750	24,860	
Old slag	3,183	25	8,590		124,200	
Cleanup	13	3	159	300	2,400	
Total lead materials	8,276	568	72,542	8,800	1,545,220	
Zinc mill cleanup	83	30	561	4,100	14,400	82,700
Total: 1954	104,522	10,754	1,966,062	4,415,900	2,356,300	82,700

[1] Excludes concentrates treated only by amalgamation and/or cyanidation.
[2] Includes lead-silver-gold-copper concentrate recovered as byproduct in the beneficiation of fluorspar at 1 plant.
[3] Less than 1 ton.
[4] Includes copper-lead-zinc ore, for which the Bureau of Mines is not at liberty to publish separate figures.

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of gross metal content

Class of material	Quantity shipped or treated (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
CONCENTRATES SHIPPED TO SMELTERS						
Dry gold	190	454	1,644	671	2,314	
Copper	7,107	5,419	107,482	2,852,941	471,780	1,112,847
Copper-lead	191	156	6,548	32,977	55,237	14,154
Lead	30,490	17,238	1,209,206	1,626,436	32,838,841	3,371,489
Total to copper and lead plants	37,978	23,267	1,324,880	4,513,025	33,368,172	4,498,490
Zinc concentrate to zinc plants	76,867	2,998	311,184	1,247,000	2,113,185	78,667,420
Total: 1954	114,845	26,265	1,636,064	5,760,025	35,481,357	83,165,910
1953	125,671	42,040	1,710,855	5,579,588	44,231,067	88,332,456
ORES, ETC., SHIPPED DIRECTLY TO SMELTERS						
Dry gold	244	692	1,099	1,069	3,092	
Dry gold-silver	279	145	6,756	1,051	10,504	503
Dry silver	95,427	9,292	1,884,665	4,513,591	1,244,736	
Copper	213	27	439	22,198	2,197	345
Lead:						
Ore	4,941	423	60,176	2,823	1,451,423	8,272
Mill cleanup	139	117	3,617	8,812	25,534	
Old slag	3,183	25	8,590		129,365	
Cleanup	13	3	159	366	2,522	
Total lead materials	8,276	568	72,542	12,001	1,608,844	8,272
Zinc mill cleanup	83	30	561	4,865	15,114	83,969
Total: 1954	104,522	10,754	1,966,062	4,554,775	2,884,487	93,089
1953	24,090	3,658	494,098	894,142	1,473,259	81,849

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TABLE 12.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties and districts, in terms of recoverable metals

County and district	Mines producing		Material sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Adams County		7			1,089	1,089		154	154				$38,254
Boulder County:													
Central (Jamestown)	1			[1] 27		27	4,381		[1] 4,381	[1] 11,500	[1] 117,300		24,373
Gold Hill	1	1	47	40	48	88	9	5	14				3,093
Ward	2		129	81		81	81		81	500	700		3,151
Chaffee County:													
Chalk Creek	2		123	20		20	302		302		21,900	23,000	6,457
Monarch	2		37				444		444		9,800	1,000	1,853
Red Mountain	1		5				4		4		300		45
Clear Creek County:													
Argentine	1		1,040	58		58	2,496		2,496	4,700	52,200		12,827
Griffith	2		207	19		19	12,398		12,398	400	22,800	1,500	15,290
Idaho Springs	6		4,127	958		958	20,061		20,061	20,900	139,000	8,500	77,812
Custer County:													
Hardscrabble	2		27	1		1	464		464		8,000		1,551
Rosita Hills	[2]		4,200	109		109	600		600				4,358
Dolores County: Pioneer	3		41,876	147		147	118,621		118,621	22,000	4,354,000	5,792,000	1,341,027
Eagle County: Red Cliff (Battle Mountain)	2		293,878	10,121		10,121	2,111,786		2,111,786	4,710,000	5,176,000	37,208,000	8,382,534
Fremont County: Hardscrabble	1		24	2		2	27		27	4,000			1,274
Gilpin County: Southern	7	2	2,822	315	4	319	4,497	1	4,498	8,000	74,000	34,000	31,406
Gunnison County:													
Elk Mountain	1		5				8		8		1,800		254
Gold Brick	1		300	59		59	165		165		400		2,268
Rock Creek	1		155	3		3	3,195		3,195		56,500		10,738
Ruby	1		1				3		3		300		44
Taylor Park	2		106				1,779		1,779		89,000		13,803
Hinsdale County:													
Galena	1		5				29		29		2,000		300
Lake	2		37	10		10	297		297		6,000		1,441
Jefferson County		4			290	290		42	42				10,188
Lake County: California	10		54,385	5,438		5,438	137,557		137,557	80,000	3,870,000	4,874,000	1,395,008
La Plata County: California	1		113	558		558	428		428				19,917
Mineral County: Creede	7		45,399	1,964		1,964	238,685		238,685	50,000	4,356,000	2,222,000	1,136,260
Montrose County:													
San Miguel River		1			6	6		2	2				212
La Sal	1		120	2		2	211		211	10,000			3,211
Ouray County:													
Red Mountain	3		72	2		2	960		960	2,900	29,600		5,850
Sneffels	1		54,640	2,683		2,683	66,997		66,997	496,800	2,226,000	1,424,000	759,851
Uncompahgre	1		22	3		3	292		292	300	6,400		1,334

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Park County:													
Buckskin	1		982	448		448	3,446		3,446	8,900	28,000	198,000	46,645
Consolidated Montgomery	1		30				11		11		1,300		188
Horseshoe	1		12				105		105		5,600		862
Mosquito Creek	(2)		9	10		10	241		241	300	1,100		807
Trout Creek Pass	1		34	2		2	115		115	800			410
Fairplay		1			49	49		9	9				1,723
Pitkin County: Roaring Fork	2		10	1		1	110		110		4,000		683
Rio Grande County: Summitville and Decatur	1		24	19		19	7		7				671
Routt County:													
Oak Creek	1		33				10		10	1,000			304
Yarmony	1		15				14		14	1,000			308
Saguache County: Kerber Creek (Bonanza)	5		378	4		4	2,938		2,938	2,000	140,000	18,000	24,513
San Juan County:													
Animas	1		3,545	312		312	11,912		11,912	12,000	312,400	30,800	71,366
Eureka	6		3,355	179		179	8,483		8,483	12,000	145,600	135,200	52,032
San Miguel County:													
Iron Springs and Upper San Miguel [1]	4		312,158	21,693		21,693	611,808		611,808	3,554,000	12,206,000	15,932,000	5,754,280
Lower San Miguel		1			1	1							35
Summit County:													
Breckenridge	4	2	12,363	351	68	419	31,207	13	31,220	30,900	2,000,000	2,372,300	582,245
Green Mountain	1		91				8,750		8,750	100	10,500		9,387
Montezuma	3		2,341	17		17	3,782		3,782	1,000	169,800	25,700	30,351
Ten Mile Consolidated	1		4				34		34		800		141
Wilkinson	1		15				61		61		900		178
Teller County: Cripple Creek	22		133,876	48,935		48,935	7,035		7,035				1,719,092
Total	123	19	973,177	94,591	1,555	96,146	3,416,846	226	3,417,072	9,046,000	35,646,000	70,300,000	21,602,205 [3]

[1] Includes amounts recovered from lead-silver-gold-copper concentrates produced as byproduct of beneficiation of fluorspar at 1 plant.
[2] Not to be counted as a mine.
[3] Bureau of Mines not at liberty to show production figures separately by district.

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Sixty-three percent of the total gold output was recovered from gold, gold-silver, and silver ores; the remainder came from copper, copper-lead-zinc, lead, lead-zinc, and zinc ores, cleanup material, and tailing. Half of the gold output was recovered from the ore and tailing by cyanidation, and one-fourth by concentration; the remainder divided between amalgamation and direct smelting.

Iron Ore.—During 1954 bog iron ore (limonite) was shipped from the Iron Springs Placer at Ophir, San Miguel County, to buyers outside the State for use as paint pigment. C. K. Williams & Co. purchased the property from Boyd Robinson in August 1954. Dick Maw & Lester Lowry were contract miners for both operators. Iron ore for the Colorado Fuel & Iron Corp. plant at Pueblo, Colo., was obtained from company mines in Utah and Wyoming.

Lead.—The output of lead from Colorado in 1954 (17,823 short tons) was 18 percent below 1953 and the lowest since 1946 (17,036 tons). A drop in the price for lead from 13.50 cents a pound at the beginning of the year to 12.50 cents by February 18 discouraged production. The price remained stationary until March 9, then rose to a high of 15 cents by October 5, where it stayed for the remainder of the year. The Government Stockpile purchasing program for lead and zinc begun in June had little apparent effect on the lead output from the State.

The Idarado Mining Co., with mining operations at the Treasury Tunnel-Black Bear group of mines in San Miguel County, was by far the leading lead producer in the State in 1954. The lead was recovered by smelting copper, lead, and zinc concentrates produced from copper-lead-zinc ore mined and milled by the company. San Miguel County contributed 34 percent of the total lead output of the State.

Other leading lead-producing mines in 1954, in order of output, were Eagle (The New Jersey Zinc Co.) in Eagle County, Rico Argentine group (Rico Argentine Mining Co.) in Dolores County, Resurrection group (Resurrection Mining Co.) in Lake County, and Amethyst group (Emperius Mining Co.) in Mineral County.

Complex ores of copper, lead, and zinc were the source of 96 percent of the total lead output, whereas ores of gold and silver supplied 2 percent. The remainder was from cleanup material, slag, and tailings. Most of the lead produced (93 percent) was recovered by smelting concentrate. The rest was derived from ore, slag, and cleanup material by direct smelting.

Molybdenum.—The entire output of molybdenum from Colorado in 1954 came from the Climax Molybdenum Co. mine on Fremont Pass 13 miles north of Leadville in Lake County. Production in 1954 was 26 percent above that in 1953. Foreign demand for molybdenum concentrate, especially in the United Kingdom and western Europe, continued to increase at a rate much greater than had been anticipated in 1953. Civilian demand was at an alltime high. The sale of concentrate produced from 5,000 tons of low-grade ores per day was assured by a Government contract through mid-1962. In addition, the company held a contract with the Government, whereby all output not sold to industry would be purchased.

Silver.—The 55-percent gain in silver output in Colorado in 1954, compared with 1953, was due primarily to an increase in the quantity of silver ore mined by the New Jersey Zinc Co. from the Eagle mine

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in Eagle County. Although the ore was classed as a silver ore, a substantial quantity of copper was also recovered.

Other important producers of silver, in order of output, were Idarado Mining Co., Emperius Mining Co., Rico Argentine Mining Co., and Resurrection Mining Co.

Tin.—The Climax Molybdenum Co. plant at Climax recovered a small quantity of tin concentrate as a byproduct from the treatment of molybdenum ore in 1954. The company has produced tin since 1949.

Tungsten.—Production of tungsten (concentrate; 60-percent WO_3 equivalent) in Colorado in 1954 increased 13 percent in quantity and 18 percent in value, compared with 1953. Most was recovered as a byproduct from molybdenum ore at the Climax Molybdenum Co. mill in Lake County. Other than small quantities produced by one company each in Fremont, Gilpin, and San Juan Counties, the remainder of the concentrate was shipped from 88 individual operations in Boulder County.

TABLE 13.—Shipments of tungsten ore and concentrate (60-percent WO_3) 1945–49 (average), 1950–54, and total 1900–54, in short tons

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	189	$260,379	1953	817	$2,902,490
1950	196	302,248	1954	927	3,420,563
1951	336	1,092,780			
1952	625	2,354,664	1900–54	27,957	33,978,963

The Hetzer custom mill operated by Hetzer Mines, Inc., produced the bulk of the Boulder County tungsten concentrate shipped. Most of the ore and concentrate treated in the Hetzer mill was supplied by Cold Spring Tungsten, Inc., second largest producer in the State. The remainder of the feed to the custom mill was from 80 or more small mines in Boulder County. On September 1, 1954, Cold Spring Tungsten, Inc., purchased all of the Hetzer Mines, Inc., stock and took over operation of the Hetzer mill.

Tungsten Refining, Inc., was the second largest shipper of tungsten concentrate from Boulder County in 1954. It operated a custom treatment plant only; ore and concentrate were purchased from at least 15 individual miners and treatment plants in Boulder County. The Marion mill, operated in 1953 by Boulder Tungsten Mines, Inc., was idle after March 1954. It was purchased in May by the Wah Chang Corp. and operated as a custom mill throughout the remainder of the year.

Five tungsten-exploration projects financed jointly by the Government and private capital under DMEA contracts totaling $93,501 were awarded in the State in 1954.

Uranium.—Exploration and exploitation of western Colorado uranium deposits continued at a substantial pace in 1954. Although discovery and development of large (greater than 100,000 tons) uranium deposits outside of the State occupied the attention of the industry, Colorado's numerous smaller deposits continued to supply a substantial portion of the Nation's output.

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The State Commissioner of Mines[4] reported that 265 uranium-mining operations were being actively developed or exploited. Most of these mines made at least one shipment, but in many the principal effort was in development. Three counties—Montrose, San Miguel, and Mesa—contained 231 of the operations, and the other 34 were scattered through 14 additional counties. Prospecting and exploration were more widely scattered and were reported from 27 counties.

Five uranium-processing plants were operated throughout the year in Garfield, Mesa, Montrose, and La Plata Counties. Three of the plants—at Durango, Naturita, and Grand Junction—arranged with the Atomic Energy Commission to expand daily capacity.

Geologic mapping and drilling were carried out by the AEC and the Federal Geological Survey in several Colorado areas. Six DMEA contracts for uranium exploration were executed (table 3) for a total amount of $232,772.

Vanadium.—Four and a half million pounds of vanadium was recovered from Colorado uranium-vanadium ores in 1954. All of the State's five uranium mills processed and recovered vanadium from uranium ores.

Zinc.—Production of zinc in Colorado in 1954 totaled 35,200 short tons, compared with 37,800 tons in 1953, and was the lowest since 1942, when 32,200 tons was produced. Thirty-three mines, prospects, and dumps contributed to the output of recoverable zinc in 1954, compared with 33 in 1953, 74 in 1952, and 100 in 1951. The drop in 1954 resulted mainly from reduction in output of lead-zinc ore from the Smuggler Union group of mines in San Miguel County operated by the Telluride Mines, Inc.

Another important reason for the decline in the zinc output was the drop in the price of zinc, compared with 1953. The average weighted price of zinc for all grades of primary metal sold by producers was 11.5 cents a pound in 1953 and 10.8 cents in 1954. The price reached a low of 9.25 cents late in February 1954, from which it rose gradually to 11.5 cents on September 7 and remained there the balance of the year.

The leading zinc-producing mines, in order of rank, were: Eagle (The New Jersey Zinc Co.), Treasury Tunnel-Black Bear (Idarado Mining Co.), Rico Argentine group (Rico Argentine Mining Co.), and Resurrection group (Resurrection Mining Co.). A $44,875 DMEA contract for exploration for lead, copper, and zinc on the Gold Ridge, Denver, and France claims was awarded to Buckskin Joe Mines, Ltd., in 1954.

NONMETALS

Cement.—The demand for cement in Colorado continued to grow in 1954 and, following the upward trend of building activity in the Rocky Mountain area, total shipments increased 9 percent over 1953. The three cement plants at Portland (wet and dry facilities) and Boettcher (dry process) operated at optimum capacity throughout 1954, producing types I, II, III oil-well, waterproof, and masonry cement, the bulk of which was shipped by truck. Limestone, clay, gypsum, and sandstone used in manufacturing cement were mined by Ideal Cement Co. and local contractors. Other raw materials

[4] Commissioner of Mines (Colorado), 1954 Annual Report, June 1955, 81 pp.

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were purchased locally or obtained from other States. Nine kilns were in operation during the year. In addition to the cement consumed in Colorado, shipments of portland, masonry, and other specialized cements were made to points in Arizona, Illinois, Iowa, Kansas, Minnesota, Nebraska, New Mexico, Nevada, Texas, and Wyoming.

Clays.—Owing to an increased demand by brick and cement manufacturers, output of all types of clay in Colorado rose to 854,791 tons, a 10-percent gain over the 1953 total. Fire-clay production decreased 29 percent, whereas miscellaneous clay increased 44 percent. The drop in mine production of fire clay can be attributed more to the lack of available deposits of this type of clay than to lessening in demand. On the other hand, miscellaneous clay or shale showed a marked gain in sales, owing largely to the increased requirements of brick manufacturers for clay building products and the high level of productive activity at local cement plants. A small tonnage of bentonite was mined and sold in Bent County during 1954 and represented the only output of this type of clay in the State. Clay was mined in 13 counties. Because of the large tonnages of miscellaneous clay mined for manufacturing cement in Fremont and Larimer Counties, these areas headed the list of those counties producing the largest quantity of clays. On the other hand, Jefferson, Pueblo, and Douglas Counties produced important quantities of fire clay and to a smaller degree miscellaneous clay, which were consumed mainly at Denver and Pueblo clay-products plants. Although the bulk of all types of clay mined in Colorado in 1954 was consumed in manufacturing building brick and other structural clay products (354,000 tons), 71,400 tons of fire clay (plastic and flint varieties) was used in manufacturing firebrick and block, as fire-clay mortar, in manufacturing clay crucibles, for zinc retorts and condensers, and in foundries and steelworks. Although this tonnage was not large in relation to the quantity of miscellaneous and fire clay used in producing heavy clay products, its role in the industry of the State to fill local demand was extremely important. Considerable effort was expended by the clay industry to locate and develop additional resources of this basic commodity.

TABLE 14.—Production of clays, 1953–54, by counties, in short tons

County	1953		1954	
	Short tons	Value	Short tons	Value
Boulder	36,958	$36,958	50,000	$37,500
Delta	390	390	528	528
Douglas	54,172	137,052	44,983	92,850
El Paso	8,726	32,392	8,393	28,639
Fremont [1]	192,390	208,419	306,743	197,185
Huerfano			6,270	32,918
Jefferson	197,454	421,756	221,440	377,545
Larimer [1]	92,223	101,450	130,274	53,803
Mesa	2,579	2,579	4,551	4,551
Pueblo	86,240	238,723	67,993	148,278
Other counties [2]	106,837	250,061	13,616	29,076
Total	777,969	1,429,780	854,791	1,002,873

[1] Including clay used in cement manufacture.
[2] Arapahoe (1953), Bent, Denver, and Las Animas.

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Mining operations in 1954 were carried on by 35 companies or individuals who either sold their entire output or used it in manufacturing clay products. Of the 855,000 tons of clays produced in Colorado in 1954, 225,000 tons was sold by producers and 630,000 tons used by producers. The largest mine operators of fire-clay deposits included the Robinson Brick & Tile Co., operating in Douglas, El Paso, and Jefferson Counties; George W. Parfet Estate, Inc., in Jefferson County; Pueblo Clay Products Co., in Pueblo County; H. M. Rubey Clay Co., Jefferson County; and S. A. Whisenhunt, Douglas County. The larger producers of miscellaneous clay included Montgomery Bros. and Lakewood Brick & Tile Co., Jefferson County; Colorado Brick Co., Boulder County; and Ideal Cement Co., Fremont and Larimer Counties.

The price of raw clay is based on type, quantity, and geographical location. The average mine price reported to the Federal Bureau of Mines for Colorado fire clay in 1954 was $2.49 a ton and for miscellaneous clay (including clay used for cement) $0.59 a ton compared with $2.65 and $1.36 (excluding clay used for cement), respectively, in 1953.

Feldspar.—The output of crude potash and soda feldspar in Colorado during 1954 continued to expand, along with increased demand for ground feldspar in pottery manufacture. A price increase for crude and ground feldspar was reported during the year and was a major factor in the sustained high level of mine output. Chaffee County was the leading producer, followed by Jefferson, Fremont, Larimer, Teller, Clear Creek, El Paso, and Douglas. Approximately 40 prospects were worked by open-pit methods in 1954, shipping crude feldspar to two grinding plants in the State. The M&S, Inc., operated its Homestake mine in the Ute Trail district of Chaffee County and was the principal individual shipper. A grinding plant at Salida operated by the Western Feldspar Milling Co. processed ore from the Homestake mine, and the Denver plant of International Minerals & Chemical Corp. purchased all its mill feed.

Fluorspar.—The sustained high level of demand for acid-grade fluorspar concentrate resulted in an 11-percent increase in sales tonnage and value during 1954. The bulk of the output went to the manufacture of hydrofluoric acid and the Government Stockpile; smaller quantities were consumed in alumina and cement plants.

Although the sales of fluorspar concentrate increased 11 percent over 1953, the production of crude fluorspar in 1954 declined 2 percent; but a better recovery, coupled with a decrease in stocks of concentrate, more than made up the drop in mine production.

The relative importance of the major producers, in terms of tonnages mined, remained nearly the same as that reported in 1953. The Northgate mines of Ozark-Mahoning reported the only increase in mine output. Decreases in crude production were reported by the General Chemical Division, Allied Chemical & Dye Corp., at its Burlington properties, and the company Brown Canyon mines, active in 1953, were idle in 1954. Further declines in output were reported by Reynolds Mining Corp. at Poncha Springs and Ozark-Mahoning Co. at its Jamestown mines. Eugene Kleinknecht and James A. Clark, who reported shipments of crude fluorspar in 1953, were idle throughout 1954.

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TABLE 15.– Shipments of fluorspar, 1945–49 (average), 1950–54, and total, 1905–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	33, 430	$961, 000	1953	53, 276	$2, 872, 360
1950	18, 489	654, 089	1954	59, 197	3, 197, 252
1951	20, 661	820, 322			
1952	29, 185	1, 505, 968	1905–54	736, 936	21, 190, 790

Despite the increase in sales of fluorspar, the industry of the State felt the effect of lower priced imports, and its relative position became less secure. The status of the market shuts out mine operators that do not have large deposits, good-quality ore, and adequate financing.

Gem Stones.—As in 1953, the principal gem stone, in terms of value mined in Colorado, was turquoise from the Villa Grove Turquoise Lode in Saguache County; however, Colorado produced a large variety of gem and ornamental stones, such as agate, amazonstone, aquamarine, beryl, topaz, tourmaline, and rose quartz.

Gypsum.—Gypsum continued to play an important role in the industrial growth of Colorado, and output in 1954 continued to expand, in keeping with the increased demand for this mineral commodity by cement and plasterboard manufacturers. The bulk of the production went to cement plants in Fremont and Larimer Counties or was shipped to plasterboard and lath plants beyond State boundaries. The Colorado Alabaster Lamp Mfg. Co. quarried a small quantity of alabaster from its deposit in Las Animas County for use in making ornamental products.

Lithium.—Although deposits of lithium minerals were known in Colorado, few appeared to have commercial possibilities, and during 1954 only one operation reported the sale of a small quantity of lepidolite. The Brown Derby pegmatite in Gunnison County was operated by the Poston Mining Co. for a short period, and shipments were made to the Beryl Ores Co. at Arvada.

Mica.—Notwithstanding a steady demand for good-quality ground mica by the roofing and oil-well-drilling industries, the production of crude scrap mica in Colorado declined in 1954, compared with 1953. The State's only mica-grinding plant at Pueblo experienced some difficulty in securing an adequate feed for its grinding facility, which was attributed to increasing mining costs, with a relatively stable mica purchase price.

Fremont County was the largest producer, with output by 7 or more individual operators. Gunnison, Jefferson, El Paso, and Clear Creek Counties, in that order, were the next most important producers. Because of the erratic nature of mining pegmatites containing good-quality mica, no 1 producer sold over 500 tons during the year.

Perlite.—After it acquired the Rosita Perlite mine in 1953 from the Alexander Film Co., the Great Lakes Carbon Corp. began an intensive development and mining program, which, in 1954, resulted in doubling the 1953 output. Nearly all mine production was shipped out of State to various expanding plants and construction companies. The Denver facility of Persolite Products, Inc., reported producing expanded perlite used in plaster and concrete aggregate.

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Pumice and Pumicite.—In spite of the decreased output reported in 1953, competition from substitute materials, and long transportation hauls, sales of volcanic scoria in Colorado during 1954 made a remarkable gain over 1953. Colorado Aggregate Co., Inc., Costilla County, and McCoy Aggregate Co., Routt County, continued to be the only mine operators, and all output was used in concrete-aggregate and concrete-block manufacture.

Pyrites.—Pyrite concentrate was recovered from molybdenum ore in Lake County and zinc-lead ore in Dolores County. Sales of pyrite concentrate in 1954 declined considerably from the 1953 level. Producers were encouraged in 1954 by the announcement of Rico Argentine Mining Co. that it will construct a $1.5 million sulfuric-acid plant at Rico. The initial output of the plant will be 200 tons per day of acid for use in treating uranium ore at mills within a radius of some 100 miles of Rico.

Sand and Gravel.—As a result of increased demand for sand and gravel by the construction industry, output of this commodity reported by commercial and Government-and-contractor producers in Colorado in 1954 rose to 13.5 million tons, a 9-percent gain over 1953. The breakdown of sales between commercial and road or highway use showed little change in 1954, compared with 1953. In 1954, 3.8 million tons was classified as commercial production and 9.7 million tons as Government-and-contractor production. This compares with 3 and 9.4 million tons, respectively, in 1953. Government-and-contractor production was reported in 55 counties and commercial output in 19; sand and gravel was produced in 55 of the State's 63 counties. Adams County, with a reported production of 1.4 million tons, was the leading producer, followed by Pueblo, Denver, El Paso, Jefferson, Arapahoe, Las Animas, and Logan.

Three-fourths of the total sales in 1954 was Government-and-contractor material used by State, county, and Federal agencies on highway and municipal road projects. Of the 3.8 million tons of commercial sand and gravel produced, 98 percent was washed, screened, or otherwise prepared. The leading producing companies included Cooley Gravel Co., Adams and Arapahoe Counties; Brannan Sand & Gravel Co., Adams and Jefferson Counties; Western Paving Construction Co., Denver County; Rio Grande Gravel Co., Jefferson County; Fountain Sand & Gravel Co., Pueblo County; White Water Sand & Gravel Co., Mesa County; Daniels Sand & Gravel Co., El Paso County; and Golden Transfer Co., Boulder County.

Stone.—Production statistics for all types of stone produced in Colorado in 1954 are not strictly comparable to those reported in 1953 owing to the inclusion of limestone used for cement in the 1954 total. However, by excluding limestone for cement, a substantial decrease in all stone produced in 1954 was reported, compared with 1953. Commercial crushed limestone decreased the most, dropping from 679,000 tons in 1953 to 539,000 tons in 1954 (exclusive of limestone for cement). A decline was also reported for commercial dimension sandstone.

Crushed limestone was the most important type of stone (in terms of tonnage) produced in Colorado during 1954, followed by dimension and crushed sandstone, crushed dimension and miscellaneous stone, dimension granite, and marble. Of the 1.7 million tons of crushed

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limestone produced, the bulk went into cement manufacture. However, substantial gains were noted in 1954 in some uses of limestone, such as in refining sugar, as a filler in asphalt, and for concrete aggregate. On the other hand, significant declines were reported for limestone used as a fluxing medium, in refractories as rock dust for coal mines, and as terrazzo.

The leading producers of limestone were Ideal Cement Co., Fremont and Larimer Counties; Colorado Fuel & Iron Corp., Chaffee and Fremont Counties; Frank H. Norberg Co., Fremont, Garfield, and Larimer Counties; Golden Cycle Corp., El Paso County; and Colorado Limestone Co., Fremont County.

Dimension and crushed sandstone was significant to a smaller degree, in the stone industry of the State. Boulder and Larimer Counties continued to be the leading producers and satisfied both local and outside requirements of this type of dimension stone. In addition, a considerable quantity of crushed sandstone was quarried and sold in these counties during the year. Fremont and Lake Counties continued to be the only source of sandstone (quartzite) suitable for manufacturing refractory material.

Vermiculite.—A small tonnage of crude vermiculite was mined in Jackson County by R. C. Quaintance and shipped to Kansas for experimental purposes. Western Mineral Products Co. continued to operate its exfoliated-vermiculite plant at Denver on crude material received from Montana mines. The finished product was used as loose-fill insulation, lightweight plaster, and concrete aggregate.

MINERAL FUELS

Carbon Dioxide.—Carbon dioxide was produced from wells in the North McCallum field in Jackson County and the McElmo field in Montezuma County.

Coal.—Coal production fell substantially in 1954 to 2.9 million tons, a 19-percent decrease from 1953. Continuing loss of markets to liquid and gaseous fuels in commercial and domestic space heating plus dieselization of the railroads have caused declines in coal production in many areas throughout the country; Colorado is no exception. Additionally, demand by coke ovens, which normally consume one-third of the State's coal output, fell 10 percent owing to general cutbacks in the production of pig iron and steel. The demand for Colorado coking coal by Colorado ovens was actually down 17 percent, but the decline was partly offset by sharply increased shipments to Utah. During the year, 172,000 tons of domestic coal was shipped to Utah, compared with 96,000 tons the year before.

Major producing counties were, in order of production, Las Animas, Weld, and Routt; these three counties produced two-thirds of the total.

Natural Gas and Natural-gas Liquids.—The marketed production of natural gas rose to 45,705 million cubic feet in 1954, a 60-percent gain over the previous year. In all, 76,000 million cubic feet was withdrawn from oil and gas wells to be sold, repressured, or vented. The quantity repressured almost doubled that wasted in 1954 (in 1953 it totaled slightly less than two-thirds), resulting in substantial improvement in conservation of the commodity.

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TABLE 16.—Coal production in Colorado by counties, 1953–54, in net tons

(Exclusive of mines producing less than 1,000 tons)

County	1953		1954	
	Production	Average value per ton	Production	Average value per ton [1]
Boulder	49,821	$5.82	33,321	$6.07
Delta	57,645	5.66	42,644	5.61
El Paso	55,927	4.25	(2)	(2)
Fremont	175,307	4.32	178,876	4.09
Garfield	35,877	4.69	29,800	6.44
Gunnison	297,860	5.52	266,733	5.27
Huerfano	135,719	6.26	55,979	5.74
Jackson	2,833	5.61	(2)	(2)
La Plata	43,800	4.17	40,446	5.05
Las Animas	1,172,771	6.69	(2)	(2)
Mesa	80,410	4.93	36,794	5.98
Moffat	89,940	5.39	(2)	(2)
Montrose	3,205	5.41	(2)	(2)
Pitkin	35,928	4.87	(2)	(2)
Rio Blanco	22,960	5.06	18,538	4.57
Routt	614,500	4.41	444,233	4.36
Weld	700,347	4.26	626,904	4.20
Other counties			1,125,523	7.03
Total	3,574,850	5.37	2,899,791	5.54

[1] Value received or charged for coal f. o. b. mine, including selling cost. Includes a value for coal not sold but used by producer, such as mine fuel and coal coked as estimated by producer at average prices that might have been received if such coal had been sold commercially.

[2] Included in other counties; not published to avoid disclosing individual operations.

Two-thirds of the marketed production was exported, and 112,666 million cubic feet was imported from adjoining States east and southeast.

In 1954 the Federal Power Commission authorized construction of the Pacific Northwest pipeline, to begin in 1955. The proposed line is to connect the natural-gas productive capacity of the San Juan Basin and other areas in western Colorado and eastern Utah to markets in the Pacific Northwest. The pipeline will be particularly beneficial to gas-producing areas in La Plata, Rio Blanco, and Moffat Counties. In conjunction with the Pacific Northwest line, the FPC also authorized construction by Colorado Interstate Gas Co. of a pipeline connecting the Pacific Northwest pipeline near Rock Springs, Wyo., to Denver.

The year saw 20 successful natural-gas wildcat wells and 52 successful development wells completed (see table 19). Half of the development drilling was in the Denver-Julesburg Basin and the remainder being in Moffat, La Plata, Baca, and Garfield Counties. In Baca County the Greenwood field of Kansas was extended across the Colorado border.

Production of natural gasoline and liquefied-petroleum gases, the bulk of which came from the California Co. plant at Rangely in Rio Blanco County, gained 20 percent over 1953.

Peat.—Peat (humus) production climbed sharply in 1954, showing a 49-percent increase over 1953. The commodity, not important quantitatively to the State mineral production, was used as a soil conditioner in nurseries and home gardens of the Denver area, where rapid growth in new-home construction and associated landscaping have strengthened the nursery business and the demand for peat.

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The State's one producer of record was McCoy & Jensen of Morrison, which operated a peat bog near Nederland, Boulder County.

Petroleum.—Colorado's crude-petroleum production felt strongly the impact of the rapidly developing Denver-Julesburg Basin in 1954, as a 9.8 million-barrel gain over the 1953 level was reported. The Adena field, a 1953 discovery in Morgan County and a small producer that year, supplied 4.6 million barrels of the 27-percent increase. Five counties, (Morgan, Logan, Washington, Weld, and Adams) all in the basin, increased output by 9.9 million barrels, which more than compensated for minor losses in other areas.

Exploration and development drilling also were concentrated in the 5 counties listed above, in which 83 percent of the wildcat holes and 93 percent of the development wells were drilled. Both types of drilling in the State almost doubled over the previous year, owing to the continuing intense interest in the area. The indicated concentration does not mean that exploration interest did not exist in other parts of the State, as 37 of the 63 Colorado counties were tested during the year. Drilling totaled 3.6 million feet for wildcats and 3.8 million for development wells.

TABLE 17.—Production of crude petroleum, 1953–54, by counties, in 42-gallon barrels [1]

County	1953	1954	Larger fields in 1954 in order of production
Adams	599,000	1,254,000	Badger Creek, Middlemist, Badger Creek-W.
Archuleta	232,000	210,000	Price Gramps and Chromo.
Boulder	3,000	2,000	Boulder.
Fremont	29,000	31,000	Florence-Canon City.
Jackson	112,000	130,000	McCallum-N and Battleship.
La Plata	12,000	11,000	Barker Dome and Red Mesa.
Larimer	107,000	114,000	Wellington, Clark Lake, Fort Collins.
Logan	5,372,000	8,103,000	Graylin-NW, Yenter, Lewis Creek.
Moffat	942,000	1,001,000	Iles, Powder Wash, Hiawatha.
Montezuma		10,000	Dove Creek.
Morgan	235,000	5,108,000	Adena, McRae, Sand River.
Rio Blanco	25,604,000	25,420,000	Rangely and Wilson Creek.
Routt	39,000	45,000	Tow Creek and Oak Creek.
Washington	2,519,000	3,411,000	Little Beaver, Bobcat, Big Beaver.
Weld	597,000	1,356,000	Black Hollow, Keota, Battle Canyon.
Total	36,402,000	46,206,000	
Average price per barrel	$2.71	$2.77	

[1] Distribution by county effected by adjusting Colorado Oil and Gas Commission data to Bureau of Mines total; differences are due to methods of collection and do not necessarily reflect errors on the part of either organization. No adjustment necessary in 1954.

The average costs of drilling and equipping a 5,340-foot well were as follows: Oil well, $50,700; gas well, $64,300; and dry hole, $26,700.[5] Costs given exclude taxes, interest on investments, overhead, and value of salvaged material after salvage. They include the cost of labor, supplies, water, fuel, and power used in such operations as erecting and dismantling rigs and derricks, drilling holes, running and cementing casing, hauling materials and installing equipment; machinery and tool charges or rentals; delivered and installed cost of equipment, such as tubing, wellhead fittings, gas traps, flow tanks, etc., and drilling or special-production derricks; the amount obligated to contractors for any of the above materials, equipment, or services

[5] Bureau of Census, 1954 Census of Mineral Industries (Preliminary Report) Crude Petroleum and Natural Gas: Series MI-13-1, October 1956.

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TABLE 18.—Production of crude petroleum, 1951–54, by fields, in thousand barrels

Field	1951	1952	1953	1954
Adena			24	4,626
Badger Creek—West			455	1,033
Big Beaver				137
Black Hollow			56	500
Bobcat				496
Divide				416
Graylin—South and Northwest	53	114	364	1,996
Lewis Creek			157	782
Little Beaver—East		50	2,539	2,687
Mount Hope—East and North	239	578	1,125	892
Plum Bush Creek				2
Rangely	22,091	22,443	22,900	22,780
Sand River				187
Wilson Creek	2,795	2,851	2,854	2,640
Yenter	420	962	1,503	1,120
Other [1]	2,225	3,383	4,425	5,912
Total	27,823	30,381	36,402	46,206

[1] Includes crude oil consumed on leases and net change in stocks held on leases for entire State.

TABLE 19.—Wildcat and development completions in 1954, by counties

[Oil and Gas Journal]

County	Oil	Gas	Dry	Total	County	Oil	Gas	Dry	Total
WILDCAT COMPLETIONS					WILDCAT COMPLETIONS—continued				
Adams	2	3	33	38	Pueblo			2	2
Arapahoe			9	9	Rio Blanco			5	5
Archuleta		1	3	4	Routt			1	1
Baca			9	9	Washington	8	3	95	106
Boulder			3	3	Weld	3	1	66	70
Cheyenne			1	1	Yuma			6	6
Crowley			1	1					
Delta			2	2	Total wildcats	42	20	595	657
Douglas			1	1					
Elbert			5	5	DEVELOPMENT COMPLETIONS				
El Paso			8	8					
Fremont			2	2	Adams	11		10	21
Garfield			1	1	Archuleta			2	2
Grand			1	1	Baca		7	1	8
Gunnison			1	1	Boulder	3		3	6
Huerfano			2	2	Garfield		1		1
Jackson	1		2	3	LaPlata		8	1	9
Jefferson			1	1	Logan	133	7	97	237
Kiowa			1	1	Mesa			2	2
Kit Carson			2	2	Moffat	3	9	3	15
LaPlata		2	7	9	Montezuma	1			1
Larimer			7	7	Morgan	208	19	46	273
Las Animas			6	6	Rio Blanco	3			3
Logan	16	2	139	157	Routt	1			1
Mesa			2	2	Washington	50	1	24	75
Moffat	2	1	7	10	Weld	31		16	47
Montezuma			4	4					
Morgan	10	7	155	172	Total development	444	52	205	701
Ouray			1	1					
Phillips			3	3	Total all drilling	486	72	800	1,358
Prowers			1	1					

where supplied by contractors; and the cost of salvaging any material for reuse. The average Colorado well was approximately 100 feet deeper than the figure given. The costs of testing ground (that is, the dry-hole cost of $5 per foot for a 5,000- to 6,000-foot well) was relatively low compared with the averages for the Nation ($34,900 per dry hole at $8.17 per foot) and other areas of the Rocky Mountains where costs ran two or more times as much. These relatively

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low costs were one reason for the Denver-Julesburg Basin's popularity with the oil industry.

Activity was also stimulated by the construction of new pipeline facilities. The Western Pipe Line Co., a Service Pipe Line Co. subsidiary, completed 22- to 24-inch crude line from Fort Laramie, Wyo., through southwestern Nebraska, northeastern Colorado, and central Kansas to Kansas City, Mo. The construction of this line was notable in that it was laid at an average speed of 10 miles a day. A second pipeline for transporting crude, solely from the Denver-Julesburg area, was completed by the Arapahoe Pipe Line Co. This 18-inch line originates at Merino Junction in Logan County and extends into eastern Kansas. Additionally the Platte pipeline, which runs through the Nebraska portion of the basin, was expanded and offered carrying capacity to producers in that area. The added pipeline facilities assured Denver-Julesburg producers an outlet to market areas and thus formed the second justification for interest in the basin.

The low-risk capital requirements and the immediate return on investment owing to ready access to markets, plus the availability of leasable land and discoveries such as the Adena field, have attracted many independent operators, as well as major oil companies, to the Denver-Julesburg Basin.

Seven petroleum refineries operated in Colorado throughout the year; 5 were in Denver and 1 each at Alamosa in Alamosa County and Rangely in Rio Blanco County. The operating capacity to process crude oil increased from 33,150 to 38,350 barrels per day.

Shale Oil.—Research and development of mining and retorting techniques to produce oil from oil shale were continued throughout the year by the Federal Bureau of Mines at Rifle, Garfield County. A complete résumé of activities was given in an annual report.[6]

REVIEW BY COUNTIES

Adams.—Adams County's mineral output gained substantially in 1954 owing to increases in production of petroleum and sand and gravel, the county's primary minerals.

Petroleum production for the county's 10 fields doubled in 1954, as the effect of 1953 discoveries was fully felt. The Badger Creek field, whose production equaled three-fourths of the county total (1,254,000 barrels) was responsible for most of the gain. Production from the Knox, Leader, and Rosener fields, which produced for the first time, totaled 48,000 barrels.

The gravel bars of Clear Creek in Adams County northwest of Denver was the major source of sand and gravel in the State. The county ranked first in the State as a producer of structural and paving sand and gravel, and 11 sand and gravel and 2 sand plants were active during 1954. To operate these facilities, an average of 110 men was employed for 250 days in quarrying and processing. The larger producers were Brannan Sand & Gravel Co., Cooley Gravel Co., Superior Sand & Gravel Co., and Karl F. Hehl Engineering Co., Inc.

[6] Bureau of Mines, Synthetic Liquid Fuels—Annual Report of the Secretary of the Interior—part 2: Rept. of Investigations, 1955, 115 pp.

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TABLE 20.—Value of mineral production in Colorado, 1953–54, by counties [1 2]

County	1953	1954	Minerals produced in 1954 in order of value
Adams	[3] $2,777,832	$4,936,143	Petroleum, sand and gravel, gold, silver.
Alamosa	71,030	74,775	Sand and gravel.
Arapahoe	864,190	485,025	Do.
Archuleta	[3] 727,504	607,552	Petroleum, sand and gravel.
Baca	43,769	43,331	Sand and gravel.
Bent	7,230	5,459	Clays.
Boulder	[3] 3,171,686	2,791,510	Fluorspar, tungsten, sand and gravel, stone, coal, peat, clays, lead, gold, petroleum, silver, copper.
Chaffee	1,763,672	1,380,763	Fluorspar, stone, feldspar, sand and gravel, lead, zinc, gold, silver.
Cheyenne	23,771	13,725	Sand and gravel.
Clear Creek	319,156	108,802	Gold, silver, lead, copper, feldspar, zinc, beryl, mica, columbium-tantalum.
Conejos	----------	53,549	Sand and gravel.
Costilla	115,378	93,201	Pumice and pumicite, sand and gravel.
Crowley	----------	7,898	Sand and gravel.
Custer	272,578	483,376	Perlite, sand and gravel, gold, lead, silver.
Delta	[3] 418,661	363,254	Coal, sand and gravel, clays.
Denver	670,597	1,119,083	Sand and gravel, clays.
Dolores	1,337,454	1,358,309	Zinc, lead, silver, sand and gravel, copper, pyrites, gold.
Douglas	295,242	136,456	Clays, sand and gravel, stone, feldspar.
Eagle	5,467,787	8,406,234	Zinc, silver, copper, lead, gold, sand and gravel.
Elbert	72,165	13,708	Sand and gravel.
El Paso	[3] 586,414	970,544	Sand and gravel, coal, stone, clays, mica, feldspar.
Fremont	7,957,047	8,594,960	Cement, coal, stone, clays, gypsum, sand and gravel, petroleum, feldspar, mica, beryl, copper, tungsten, gold, columbium-tantalum, silver.
Garfield	[3] 198,907	418,916	Sand and gravel, coal, stone.
Gilpin	7,510	31,783	Gold, lead, silver, zinc, copper, tungsten.
Grand	416,442	61,368	Sand and gravel.
Gunnison	[3] 1,697,178	1,588,961	Coal, sand and gravel, lead, silver, mica, columbium-tantalum, gold, beryl, lithium minerals.
Hinsdale	4,985	3,452	Sand and gravel, lead, gold, silver.
Huerfano	[3] 851,121	354,321	Coal, clays.
Jackson	1,443,726	2,189,476	Fluorspar, petroleum, sand and gravel, coal, vermiculite (crude).
Jefferson	[3] 1,133,524	1,137,214	Sand and gravel, clays, feldspar, gold, columbium-tantalum, mica, beryl, silver.
Kiowa	----------	35,882	Sand and gravel.
Kit Carson	1,430	61,113	Do.
Lake	37,547,577	50,346,551	Molybdenum, tungsten, lead, zinc, gold, silver, pyrites, copper, tin, sand and gravel, stone.
La Plata	[3] 422,039	447,683	Coal, sand and gravel, petroleum, gold, stone, silver
Larimer	4,301,669	4,986,292	Cement, stone, petroleum, sand and gravel, gypsum, clays, feldspar, beryl.
Las Animas	[3] 7,991,361	6,475,547	Coal, sand and gravel, clays, gypsum.
Lincoln	26,676	338,131	Sand and gravel.
Logan	[3] 14,605,585	22,619,826	Petroleum, sand and gravel.
Mesa	[3] 607,017	513,618	Sand and gravel, coal, clays.
Mineral	861,643	1,156,181	Lead, zinc, silver, gold, sand and gravel, copper.
Moffat	[3] 3,456,591	3,252,952	Petroleum, coal, sand and gravel.
Montezuma	----------	27,699	Petroleum.
Montrose	[3] 323,002	108,857	Sand and gravel, coal, copper, gold, silver.
Morgan	[3] 654,316	14,223,951	Petroleum, sand and gravel.
Otero	[3] 237,610	27,591	Sand and gravel.
Ouray	[3] 929,907	767,035	Lead, zinc, copper, gold, silver.
Park	193,255	74,340	Sand and gravel, zinc, gold, lead, silver, copper.
Phillips	18,114	3,967	Sand and gravel.
Pitkin	[3] 181,797	[4]	Coal, lead, silver, gold.
Prowers	66,697	137,319	Sand and gravel.
Pueblo	848,012	793,880	Sand and gravel, clays.
Rio Blanco	[3] 69,602,681	70,527,268	Petroleum, coal, sand and gravel.
Rio Grande	133,240	671	Gold, silver.
Routt	[3] 2,922,807	2,216,632	Coal, pumice and pumicite, petroleum, sand and gravel, copper, silver.
Saguache	89,484	99,211	Sand and gravel, lead, silver, zinc, copper, gold.
San Juan	840,937	151,272	Lead, sand and gravel, silver, zinc, gold, copper, tungsten.
San Miguel	[3] 7,837,566	5,836,227	Zinc, lead, copper, gold, silver, iron ore, sand and gravel.
Sedgwick	12,800	1,074	Sand and gravel.
Summit	702,158	686,472	Lead, zinc, sand and gravel, silver, gold, copper.
Teller	1,845,962	1,760,659	Gold, stone, sand and gravel, silver, feldspar.
Washington	[3] 6,848,532	9,489,912	Petroleum, sand and gravel.

See footnotes at end of table.

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TABLE 20.—Value of mineral production in Colorado, 1953–54, by counties [1] [2]—Continued

County	1953	1954	Minerals produced in 1954 in order of value
Weld	$4,804,509	$6,653,541	Petroleum, coal, sand and gravel.
Yuma	10,650	80,629	Sand and gravel.
Undistributed	[3] [5] 9,944,095	15,181,174	
Total	[3] 211,586,000	[6] 256,197,000	

[1] Value of carbon dioxide, natural gas, natural-gas liquids, vanadium and some beryllium (1954), clays (1953), columbium-tantalum (1954), gem stones, mica (1953), and sand and gravel that cannot be assigned to a specific county is included with "Undistributed."
[2] Value of low-grade manganese ore shipped to General Services Administration Depots and uranium excluded.
[3] Revised figure.
[4] Value included with "Undistributed" to avoid disclosure of individual company operations.
[5] Adjusted to avoid duplication of value in clays for cement.
[6] The total has been adjusted to eliminate duplication in the value of clays and stone.

Placer gold containing some silver was recovered as a byproduct at some sand and gravel washing and screening plants. Most output was by Kerkling & Slensker (partnership) in sluice boxes at the stationary plants of Brannan Sand & Gravel Co. (pits 8 and 10), Superior Sand & Gravel Co., and F. S. Rizzuto. Additional recovery was made by Cooley Gravel Co., using sluice boxes on the floating washing plant (fed by a dragline) at the North Plant pit. Smaller quantities of placer gold were won at gravel-washing plants by Harry Broda at the Montgomery Bros. gravel pit and R. V. Madden from the Karl F. Hehl Engineering Co., Inc., gravel pit.

Arapahoe.—Sand and gravel dominated the output of mineral commodities in Arapahoe County in 1954, and the clay pits operated during the previous year were idle in 1954. Of the 564,000 tons of sand and gravel sold or used during this period, 455,000 tons was sold by commercial producers for building and structural purposes, whereas 109,000 tons was quarried and prepared by private contractors for use on State, county, and city roads. The larger commercial producers were the Cooley Gravel Co., Hall Sand & Gravel, Inc., Herbertson Sand & Gravel Co., William E. Russell Sand & Gravel, and Denver Mortar & Materials Co. The only contractors reporting production for a road project were Karl F. Hehl Engineering Co., Inc., and McMillon Construction Co., Inc.; the bulk of the output was quarried by maintenance and construction crews working for the Arapahoe County Highway Department.

Shipments of uranium ore were reported from Arapahoe County mines.

Baca.—The Greenwood natural-gas field of Morton County, Kans., was extended into Colorado through development drilling by Amerada Petroleum Corp., British-American Oil Producing Co., and Southwestern Exploration Co. At the year end seven successful development wells had been drilled in the Colorado portion of the field.

Bent.—The Clay Productions, Inc., operated its open-pit bentonite property for a short period during 1954, and 244 tons of ground bentonite for rotary-drilling mud was ground and shipped from material mined in 1954 and stockpiled. The Colo-Tex Mining &

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Engineering Co. continued to mine fire clay and ship it to consumers for use in manufacturing fire-clay mortar.

Boulder.—The production and sales of nonmetals represented 56 percent of the total value of output in Boulder County during 1954. Fluorspar, sand and gravel, stone, and clay, in order of importance, made up the nonmetal group. The Burlington mine of the General Chemical Division, Allied Chemical & Dye Corp., was the largest producer of fluorspar, followed by the Emmett, Blue Jay, Argo, and Spartan No. 5, all operated by Ozark-Mahoning Co. Burlington ore was trucked to the company concentrating plant at Valmont near Boulder, and Ozark-Mahoning Co. operated its mill near Jamestown. Underground operations at the Burlington mine utilized 34 miners who worked an average of 259 days, whereas 7 men worked a like period in surface operations. On the other hand, 14 men were employed an average of 328 days at the mill near Boulder. Employment at the Argo, Blue Jay, Emmett, and Spartan No. 5 mines averaged 28 men who worked 250 days during the year.

The major portion of the sand and gravel production in Boulder County in 1954 was commercial output, the bulk of which was sold by the Golden Transfer Co. and Boulder Gravel Products, Inc. In terms of dollars, sales of structural gravel for residential and industrial construction were the outstanding source of income to the sand and gravel industry, followed by sales of a smaller quantity of structural sand. Highway contracts let by the State highway department resulted in the production of 111,000 tons of sand and gravel by Peter Kiewit Sons Co., J. H.-N. M. Monaghan & Associated Cos., and Brown Construction Co.—contractors for the State highway department.

Boulder County produced the bulk of the dimension and crushed sandstone quarried in Colorado during 1954 from the famous sandstone beds near Lyons. In terms of value, rough construction building stone was the most important product, followed by flagging and dressed building stone. However, in spite of the continued technologic improvements in quarrying operations, the output of this commodity continued to decline in 1954 owing to the trend away from the use of large quantities of stone in building construction. Larger producers included Dewey H. Summers, Colorado Stone Co., Brodie's St. Vrain Stone Quarries, Jacobson-Evans Stone Co., Inc., and Stockton Stone Yard.

The Colorado Brick Co. (formerly Longmont Brick & Tile Co.) operated a number of clay pits near Boulder, producing miscellaneous clay for use at its brick plant at Valmont. All mine production was consumed in manufacturing brick and other heavy clay products.

Tungsten ranked second to fluorspar in Boulder County in 1954, in terms of value of output. Eighty-eight individual operations produced tungsten in the county in 1954. Hetzer Mines, Inc., operated the Hetzer custom mill (formerly Wolftongue) at Nederland and produced the bulk of the tungsten concentrate shipped from the county. Cold Spring Tungsten, Inc., supplied most of the ore and concentrate to the Hetzer mill. Ore and concentrate also were received at the Hetzer mill from a large number of small-scale producers in Boulder County. Cold Spring Tungsten, Inc., bought the Hetzer mill on September 1 and operated it throughout the remainder

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of 1954. Tungsten Refining, Inc., operated a custom mill in Boulder County, received ore and concentrate from individual producers, and shipped the second largest quantity of tungsten concentrate in the county in 1954. Wah Chang Corp. of New York purchased the Marion mill from the Boulder Tungsten Mines, Inc., in May and operated it for the rest of the year.

A moderate quantity of lead and smaller quantities of gold, silver, and copper were produced in the county. Most of the lead, along with some gold, silver, and copper, was recovered from lead concentrate produced as a byproduct of the treatment of crude fluorspar at the Ozark-Mahoning Co. Jamestown operation (Argo, Blue Jay, Emmett, and Spartan No. 5 mines). O. H. Curtright conducted exploration on the White Raven mine and made a 2-ton test shipment of lead ore.

The remaining gold was produced from 2 lode mines and 1 placer mine in the county in 1954. The Poorman mine was operated under lease by the Gibson Investments, Inc., from the beginning of the year until May 10, when it was turned back to the owners, G. L. & Norman Frank, Fred E. Tracy, and L. C. Tyrer, who operated it throughout the remainder of 1954. The Gold Range, Inc., conducted development work and mined and milled gold ore from the Utica group of mines—Comstock, New Market, and Utica—during part of the year.

Incidental to the sand-and-gravel washing and screening operation at its plant at the George Sawhill ranch pit, Edgar T. Curtright recovered a small quantity of placer gold.

A tipple fire that completely destroyed the hoisting shaft caused permanent sealing and abandonment of the Hi-Way coal mine, which had been employing 25 men.

Chaffee.—Except for a small quantity of gold, silver, lead, and zinc production, nonmetallic minerals comprised 99 percent of the value of output by the mineral industries of Chaffee County in 1954. Of the nonmetals, only feldspar and sand and gravel reported increases in the value of output, whereas significant declines were noted in sales of fluorspar and stone. In the metals group, the value of production of lead and silver increased, and gold and zinc declined. No copper was produced in 1954, compared with 1 ton in 1953.

The Poncha Springs mine of Reynolds Mining Corp. was the only fluorspar mine active during 1954, and output dropped substantially below that in 1953. The General Chemical Division, Allied Chemical & Dye Corp., Brown Canyon mines were idle throughout the year.

Dimension and crushed stone, the second most important mineral commodities produced in the county, dropped in value of output from $796,000 in 1953 to $554,000 in 1954. The main reason for the decline was a reduction in shipments of crushed limestone from the Monarch quarry of the Colorado Fuel & Iron Corp. Deliveries to the company Pueblo steel plant decreased from 443,000 tons in 1953 to 314,000 in 1954, as a result of the curtailment of steel production to allow liquidation of excess inventories. The Colorado Granite Co. produced a small quantity of dressed monumental stone for the local market.

All sand and gravel output in Chaffee County was produced by a private contractor working on a State highway department project

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and by construction and maintenance crews of the Chaffee County Highway Department.

Clear Creek.—The total value of mineral production in Clear Creek County in 1954 dropped to one-third the 1953 figure, largely because of a drop in the metals output. Nine lode mines producing gold, silver, copper, lead, and zinc and no placer gold mines were operated in the county in 1954, compared with 16 and 1, respectively, in 1953.

The major metal producers were: Grizzly Gulch lead mine of the Lupton Mining Co. in the Argentine district, Smuggler lead-zinc mine operated by Lawrence Schreiner in the Griffith district, and Dixie No. 4 of the LeRoy Giles & Co., Lake gold-silver mine operated under lease by William Kirschmer & Pete Leavitt, and Nabob lead mine of Nabob Lease in the Idaho Springs district of Clear Creek County.

The Lamartine mill burned in the spring of the year and was not replaced. LeRoy Giles & Co. treated the gold ore mined from the Dixie No. 4 mine in its mill and also accepted custom ore for milling. The Silver Spruce Gold Mining Co. did some custom milling, but enough ore was not available to keep either mill in steady operation.

The Jo Reynolds mine near Lawson, known to contain pitchblende in the early 1900's, was being reopened by the Reynolds Uranium Corp. Prospecting in the county discovered several uranium-bearing pegmatites, which, however, were of questionable commercial value, due to the refractory nature of the minerals involved.

The only output of nonmetals recorded in Clear Creek County during 1954 resulted from the mining of a pegmatite deposit by Joe Grover. A small quantity of crude feldspar was shipped to a mill at Denver, and some scrap mica was sold to a mica-grinding plant at Pueblo. Beryl and columbite-tantalite also were produced and sold to Beryl Ores Co.

Costilla.—Pumice and sand and gravel were the only mineral commodities reported as produced and sold in the county during 1954. The Colorado Aggregate Co., Inc., operated its open-pit mine 300 days and employed 2 men. The crushing plant was operated for the same length of time, and 5 men were engaged in preparing scoria as an ingredient of concrete aggregate and roofing compounds. The demand for this commodity remained stable, but the average price dropped as a result of competition from substitute materials. The company was engaged in a remodeling program in its processing facility during part of the year.

Government-and-contractor production of paving gravel by Edward Selander constituted the entire output of this commodity and resulted from a highway contract let by the State highway department.

Custer.—Sales of nonmetals in 1954 were again the major source of income to the mineral industries of Custer County. Crude perlite from the Rosita open-pit mine of Great Lakes Carbon Corp. contributed most of the value of mineral output in the county. Shipments were made to various expanding plants and construction companies throughout the United States. C. J. Barnhisel Construction Co. (contractor for Great Lakes Carbon Corp.) employed 5 men for an average of 260 days in mining operations.

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The only production of gravel reported in 1954 resulted from a gravel-surfacing contract executed by Brown Construction Co. for the Colorado Highway Department.

A small test shipment of lead ore was made from the Little Annie mine during 1954 by the partnership of J. L. Mulkey & E. A. Susel. The Passiflora Mining Co. drove a development crosscut at its mine near Westcliffe in the Hardscrabble district and made a shipment of lead ore containing some silver in addition to lead. The Metallics Recovery Corp. (formerly Metallics Recovery & Process Corp.) recovered a moderate quantity of gold and silver from the Bassick mill tailing while conducting tests for developing a process for recovering the metals.

Delta.—With the decreased value of coal produced in Delta County during 1954, the sales of sand and gravel and clay became a more important source of income for the mineral industries of this region. The Delta Sand & Gravel Co. engaged 6 men for 260 days in quarrying and processing structural and paving sand and gravel for the local market. The county highway department, through its maintenance and construction crews, produced a large quantity of paving gravel for use on county roads.

Clay output was reported by the Delta Brick & Tile Co., which produced 550 tons of miscellaneous clay for its own use in manufacturing building brick and other structural clay products. Four men were employed 24 days in mining operations.

Uranium prospectors were reported active in the Black Canyon, Dominquez Creek, Mesa Creek, North Fork of the Gunnison River, Red Canyon, and Wells Creek areas.

Denver.—Manufacturers of brick and tile, concrete and cinder block, concrete and clay sewer pipe, and other construction materials in Denver provided a market for several nonmetals mined in this and adjacent counties. Denver continued to be the focal point for manufacturing brick and other structural clay products in the State, and plants were operated by Clark Brick, Inc., Denver Fire Clay Co., Denver Sewer Pipe & Clay Co., Denver Terra Cotta Co., Overland Pressed Brick Co., Robinson Brick & Tile Co., and Western Tile Manufacturing Co. In addition to brick and other clay products produced by these manufacturing facilities, the Denver Fire Clay Co. and Denver Sewer Pipe & Clay Co. manufactured refractory-grade products. Raw clay was obtained locally and from out-of-State suppliers.

A considerable quantity of sand and gravel was used in Denver County in constructing and maintaining streets and highways. Private contractors for the State highway department and the city engineer were responsible for this production. The contractors included Western Paving Construction Co., Lawrence Construction Co., C. L. Hubner Co., Northwestern Engineering Co., Latimer Construction Co., and James B. Kinney, Inc.

Several nonmetallic-minerals processing plants active during the year played an important part in the industrial growth of Colorado. Consolidated Feldspar Department, International Minerals & Chemical Corp., operated its Denver feldspar-grinding plant on crude material from mines in adjacent counties. Western Mineral Products Co. produced exfoliated vermiculite at its Denver plant from crude

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vermiculite from Montana, and General Chemical Division, Allied Chemical & Dye Corp., operated its sulfuric-acid plant on pyrite concentrate obtained from Lake County.

Dolores.—The total value of the 5 metals, gold, silver, copper, lead, and zinc constituted 99 percent of the total value of the mineral production in the county in 1954. The Rico Argentine Mining Co. operated its lead-zinc mine and 150-ton-per-day flotation mill at Rico throughout 1954 at about the same rate as 1953, despite the drop in the price of lead and zinc. Lead, zinc, and pyrite concentrates were produced from the ore. A main tunnel was driven under the old Argentine and Blaine workings which will connect with the Argentine shaft. Construction of a plant was also begun to manufacture sulfuric acid from the pyrite produced. Minerals M & M, Inc., leased the Union Carbonate mine in August 1954 and mined and milled a substantial quantity of lead ore, from which gold and silver were recovered, in addition to lead.

Sand and gravel was quarried and prepared by maintenance and construction crews of the Dolores County Highway Department.

Douglas.—Mining and preparation of nonmetals were the sole sources of income to the mineral industries of the county during 1954. Clay, sand and gravel, stone, and feldspar were mined and sold, but the total value of mineral production declined in relation to 1953. Fire clay mined by Robinson Brick & Tile Co., W. H. Hedley, Helmer Bros., and S. A. Whisenhunt was shipped to Denver plants for the manufacture of clay products; the output dropped to 45,000 tons in 1953. Contractors working on State highway projects and construction and maintenance crews of the county highway department produced 145,000 tons of paving gravel in 1954, a 39-percent drop from 1953. John T. and Francis Fox quarried a small quantity of crushed limestone used for riprap, and Don Clements shipped a small tonnage of crude feldspar to Denver for milling.

Eagle.—The total value of Eagle County mineral production in 1954 advanced 54 percent above 1953. An increased output of silver ore, containing a substantial quantity of copper and gold along with silver, from the Eagle mine of the New Jersey Zinc Co. at Gilman accounted for the rise in mineral output in the county. The company was the leading producer of silver, copper, and zinc, and ranked as second highest producer of lead and fourth highest producer of gold in Colorado in 1954. The lead-zinc ore mined was milled at the company 1,000-ton-per-day underground mill and the lead and zinc concentrates produced were shipped for smelting. In addition, silver ore was shipped directly to the smelter to recover contained silver, copper, and gold.

El Paso.—Despite an increase in the output of coal in El Paso County in 1954, sales of sand and gravel, stone, clay, mica, and feldspar made the major contribution to the value of mineral production. Of the 674,000 tons of sand and gravel sales, 33 percent or 221,000 tons was classified as commercial output and 453,000 tons as Government-and-contractor production. Daniels Sand & Gravel Co. and Pikes Peak Fuel Division of the Golden Cycle Corp., the leading commercial producers, sold mainly structural sand. On the other hand, G. E. Blanchard, Peter Kiewit Sons Co., and Henry Shore Co. consumed 206,000 tons of paving gravel in connection with highway contracts

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held by these concerns. Maintenance and construction crews for the county highway department and the street department of the city of Colorado Springs produced the remaining 247,000 tons of Government-and-contractor output.

Crushed limestone used in concrete aggregate was the only type of stone quarried in El Paso County during 1954, and the Lennox-Breed quarry operated by the Golden Cycle Corp. was the only mine operated.

The output of fire clay in 1954 remained at relatively the same level as that reported in 1953 and mine production came from three open pits operated by National Clay Products Co., Robinson Brick & Tile Co. (Apache No. 7 mine), and Standard Fire Brick Co. (Husted mine). The bulk of the output was fire clay, although some miscellaneous clay was mined. All production was used in manufacturing building brick and other structural clay products.

The Valley View pegmatite, operated by W. A. Cocreham, was the source of a small quantity of crude feldspar shipped to Denver and scrap mica ground at the Pueblo grinding plant of Western Non-Metallics, Inc. Roy Tull, working the Little Annie pegmatites, also shipped a small lot of feldspar to Denver for processing.

Fremont.—Although the mineral industry of Fremont County produced an impressive list of mineral commodities—6 in the metallic group, 7 in the nonmetallic group, and coal and petroleum—the nonmetallics supplied 90 percent of the total value of mineral output. Cement ranked first, followed by stone, clays, gypsum, sand and gravel, feldspar, and mica. Of this group, only the value of clay sold or used declined. Of the mineral-fuels group, coal tonnage increased slightly, but value decreased, and petroleum production remained essentially constant. On the other hand, sales of gold, silver, copper, columbite-tantalite, and tungsten were reported in 1954, compared with none in 1953, and there was a substantial gain in the production of beryl.

One of the two cement plants in Colorado was at Portland and was owned and operated by Ideal Cement Co. The plant, utilizing a wet and dry process and rated at 2.64 million barrels a year, consumed 45.1 million kilowatt-hours of purchased electrical energy in manufacturing types I, II, and III, portland-waterproof, and masonry cement. Two 400-foot and five 120- to 125-foot rotary kilns were operated during the year, and, in addition to markets for cement in Colorado, shipments were made to consumers in Arizona, Illinois, Iowa, Kansas, Minnesota, Nebraska, New Mexico, and Texas.

Crushed limestone was the most important source of income to the stone industry, and the bulk of the output was produced by Ideal Cement Co. and used in manufacturing cement. Crushed limestone was also sold or used for fluxing purposes, sugar refining, dust control in coal mines, and terrazzo by Colonna & Co. of Colorado, Inc., Colorado Fuel & Iron Corp., Colorado Limestone Co., and Frank H. Norberg Co. Crushed sandstone was used as a refractory stone in manufacturing refractory brick for furnace and converter lining at the Pueblo steel plant. Ray B. Sturbaum was the major producer, operating the Burnite Ganister quarry, followed by Laclede-Christy Co. of Colorado at the Ganister quarry and the Standard Fire Brick Co. Penrose quarry. V. D. Coleman & Co. produced a small quantity

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of rough monumental dimension granite, and the county highway department quarried a significant tonnage of crushed granite and dimension and crushed miscellaneous stone for use in constructing and maintaining county roads.

Crude gypsum was quarried by two mine operators in 1954, and sales increased slightly over the 1953 figure owing to the gain in demand for gypsum in manufacturing cement. Nat Senatore was again the contractor-mine operator for Ideal Cement Co., and 3 men were employed 208 days in the mining operation. The Colorado Limestone Co. produced 268 tons of agricultural gypsum from its Coaldale pit.

Clay-mining activity in Fremont County in 1954 centered around the operations of the Ideal Cement Co., which accounted for all of the county output of miscellaneous clay and the bulk of the total clay production. Although mining activity for miscellaneous clay provided the greater portion of employment for miners, Laclede-Christy Co. of Colorado operated its Flint fire-clay mine 200 days during 1954 and employed 6 men in its mining operations. In addition, Casimero Alvederez and John Silengo reported production of a small quantity of fire clay from the Black Knight and Chandler mines.

In line with the general upward trend in construction, the output of sand and gravel increased from 62,000 tons in 1953 to 165,000 tons in 1954. This gain resulted mainly from greater demand for aggregate in constructing and maintaining highways. The bulk of the output was produced by G. E. Blanchard and Brown Construction Co. as contractors for the Colorado Highway Department and construction and maintenance crews of the county highway department. Seng's Sand & Gravel plant produced and sold the only commercial sand and gravel in the county.

Feldspar mining was concentrated in the Canon City-Parkdale area of Fremont County during 1954, and production increased from 2,300 tons in 1953 to 3,300 in 1954. Louis Arko, operating the Spikebuck mine, was the leading shipper, followed by Alex Lockhart on the Mica Lode. All producers shipped to the Parkdale stockpile of International Minerals & Chemical Corp., and the feldspar eventually was processed at the company Denver grinding plant.

In conjunction with feldspar-mining operations, a number of producers recovered 1,000 tons of scrap mica, which was shipped to a grinding plant at Pueblo. Alex Lockhart was the principal producer, followed by Hardesty & Langford, Kenneth Cox, and Louis Arko.

Copper ore, from which small quantities of gold, silver, and copper were recovered, was mined from the Green Mountain property in the Hardscrabble district by Carl A. Lundquist and shipped to a smelter.

Kenneth Cox produced beryl and columbite-tantalite from the Devil's Hole mine and sold it to the Beryl Ores Co. Earl McDaniel and Alex Lockhart sold beryl produced from the Mica Lode to International Minerals & Chemical Corp.

The Florence-Canon City field produced 31,000 barrels of oil from 35 wells. Over 14 million barrels of crude petroleum has been produced since the field's discovery in 1862.

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Garfield.—Nonmetallics (sand and gravel and stone) furnished 54 percent of the total value of mineral production in 1954, compared with 15 percent in 1953. This marked increase can be attributed entirely to the activities of private contractors working on highway contracts let by the State highway department. The contractors were E. J. Rippy & Sons, Schmidt Construction Co., and Gardner Construction Co. Commercial sand and gravel was sold by E. R. Coulter, who employed 3 men 60 days in quarrying and processing.

Frank H. Norberg Co. continued to produce crushed limestone during 1954 and supplied the entire output of this commodity. Shipments were made to sugar plants, to be used in refining sugar, steel plants for fluxing purposes, and to construction contractors for use in concrete aggregate.

United States Vanadium Corp. operated its processing plant at Rifle throughout the year, producing uranium and vanadium concentrates from company and custom ores.

Gilpin.—Production of gold, silver, copper, lead, zinc, and tungsten constituted the entire mineral output of Gilpin County in 1954 as in 1953. Its value in 1954 was four times the 1953 figure. The gain in output probably resulted from the increased activity prompted by the search and exploration for uranium in the county. Seven lode mines producing gold, silver, copper, lead, and zinc, 1 tungsten mine, and 2 placer-gold mines were active in 1954, compared with 6, 0, and 4, respectively, in 1953. United Mining & Leasing Corp. (Carroll, Two Sisters, and Eureka mines), Cherokee Uranium Mining Corp. (Cherokee Shaft), and The Realty Co. (East Calhoun) were among the larger producers in the county in 1954.

The Central City district was one of the first producers of pitchblende used as a source of radium in the early part of the century. Many of the older base-metal mines underwent reexamination in 1954 in search of possible uranium-ore bodies.

Grand.—Uranium production was reported from the county in 1954. Two active mines were the Fair U near Old Stormy, operated by Karl N. Soder, and the Undecided group on Beaver Creek, operated by Newmont Exploration Co.

Gunnison.—The Oliver No. 2 coal mine was permanently sealed in October owing to an excessive gas inflow that endangered further operation. The mine was 1 of 3 operated by Minerals Development Corp.; in 1953 it produced a fifth of the county output of coal. Gunnison ranked as the State's fourth highest producing county; approximately 250 men were employed at 14 operations. Major operators were Minerals Development Corp., Champion Coal Mining Co., and Bear Coal Co.

Production of gold, silver, and copper from 6 mines in 1954 was considerably more than from the 3 mines active in 1953. Although the value of the output was relatively insignificant in terms of the total value of mineral production in the State, the increased output and overall activity was significant. The Beryllium Mining Co., Inc., produced beryl and columbite-tantalite from the Willow Creek mine.

In terms of value, sand and gravel was the only nonmetal commodity of any consequence produced in Gunnison County during 1954, even though a small quantity of scrap mica and lithium was

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sold. Paving sand and gravel was quarried and prepared by contractors for the Colorado Highway Department and construction crews for the county highway department. The Brown Derby pegmatite in the Quartz Creek district near Ohio was operated by Adolph Poston Mining Co., and a few tons of lepidolite was shipped to the Beryl Ores Co. at Arvada. In addition to lithium, a small quantity of scrap mica was recovered and sold to Western Non-Metallics, Inc., at Pueblo.

Hinsdale.—Three mines—Capital City (John Hagman & Joe Gomez), Black Crook (F. M. Mendenhall & J. F. Swank), and Garlock (Joe Gomez)—produced small quantities of gold, silver, and lead in the county in 1954.

Sand and gravel production was reported by M. C. Jacobs Construction Co. which was engaged in highway work for the State highway department. County construction crews also produced some paving gravel for their own use.

Jackson.—Fluorspar production dominated the activity of the mineral industry in Jackson County in 1954. Output from the Northgate mines of Ozark-Mahoning Co. increased 59 percent over 1953. An average of 46 men was employed approximately 280 days during 1954 in underground and open-pit mining and 15 men 266 days at the company mill near Jamestown. The finished fluorspar concentrate was shipped to manufacturers of hydrofluoric acid and to aluminum-reduction plants.

All sand and gravel output in 1954 was classified as Government-and-contractor, produced and resulted from contracts let by the State highway department and the Federal Bureau of Public Roads.

For the first time in a number of years, crude vermiculite was mined in the Cowdrey area. R. C. Quaintance reported sales of a small quantity of this crude material for experimental purposes.

Oil production from Jackson County's North McCallum field and the newly discovered Battleship field was 130,000 barrels. The Lion Oil Co. No. 1 Dwinnell brought in the Battleship field, which at year end had produced 9,000 barrels of oil from the Dakota formation. In 1953 traces of oil had been reported from drilling in the vicinity.

Carbon dioxide was produced from the North McCallum field.

Jefferson.—The value of output of all mineral commodities produced in Jefferson County in 1954 remained the same as that reported in 1953, and the contribution toward total value by nonmetals rose from 96 percent in 1953 to 99 percent in 1954. Sand and gravel and clay were the most important commodities in terms of value, and increases over 1953 were recorded. Feldspar and mica output declined from those reported in 1953. The production of all metals declined in 1954. Gold, silver, beryl, and columbite-tantalite were among the metallics produced. No copper was recovered in 1954, whereas 3 tons was sold in 1953.

Demands by the construction industry generated considerable activity in the construction-materials field. Of the 658,000 tons of sand and gravel produced in 1954, 504,000 tons was sold as commercial structural and paving sand and gravel by Rio Grande Gravel Co., Hale Bros. Sand & Gravel, Inc., Brannan Sand & Gravel Co., H. N.

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Lee Sand & Gravel Co., and Lake Sand & Gravel Co., which employed an average of 26 men throughout the year. Henry Shore Co., Brown Construction Co., and Northwestern Engineering Co., as contractors for the State highway department, produced 153,000 tons of paving gravel for highway use.

In terms of tonnage, Jefferson County was the most important supplier of fire and miscellaneous clay to Denver clay manufacturers. Some 15 opencut and underground mines were active, and 70 men were employed for periods of 22 to 300 days; the average being 250. The Rockwell and Apex open-pit mine operated by George W. Parfet Estate, Inc., was the leading producer, and 7 men worked 300 days mining fire clay. The Cowan open-pit mine was worked by the Montgomery Bros. and produced miscellaneous clay for brick manufacture. H. M. Rubey Clay Co. engaged 5 men in mining for 300 days and produced plastic fire clay for its own use. The Lakewood Brick & Tile Co. was the next largest producer who employed 4 men for 260 days mining miscellaneous clay for its brick plant. The Robinson Brick & Tile Co. operated its Chieftain and Stranger mines, and the fire clay produced was for its own account. The Denver Fire Clay Co. and Denver Sewer Pipe & Clay Co. worked the North and South Golden, Strainland, and Johnson mines, respectively, for fire clay, which was used at their Denver plants and sold to other consumers.

Other production was reported by Coors Porcelain Co., Fred S. Caldwell, Golden Fire Brick Co., W. H. Warner, and Western Tile Manufacturing Co. The Denver Terra Cotta Co. employed 2 men for 253 days in exploration and development of its underground clay property.

Feldspar mining was relatively stable during the year, as mine sales in 1954 were 13,000 tons compared with 13,720 in 1954. R. V. McGuire was the leading producer and operated the Bossy, Lone Lode, and Tall Timber mines, followed by Marvin Heglin on the Miller Lode and Don Clements on the "Q" Lode. In conjunction with feldspar, a small tonnage of scrap mica was recovered by R. V. McGuire's operation of the Lone Lode and Ben Waltz and K. R. Hewitt on the Biggar mine. Hewitt also produced beryl and columbite-tantalite.

The gold and silver produced in the county in 1954 was recovered as a byproduct at four sand-and-gravel washing and screening plants. W. B. Kerkling led the four producers of placer gold and silver.

Some uranium prospecting and drilling were carried out during the year. Development and exploration at the Schwartzwalder mine on Ralston Creek were continued by Fred Schwartzwalder.

Lake.—Molybdenum was again the dominant metal mined in Lake County, as it has been since 1929, when the value of the molybdenum produced first exceeded the combined value of gold, silver, copper, lead, and zinc. The molybdenum output came from the Climax mine of the Climax Molybdenum Co. 13 miles north of Leadville. Except for 4 years, 1920–23, inclusive, the mine has been a steady producer since the first shipment of concentrate in 1918. The following data are abstracted from the Climax Molybdenum Co. annual report to the stockholders for the calendar year 1954.

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The Company's production of molybdenum during the past five years was as follows:

Year:	*Pounds of molybdenum contained in concentrate*
1950	11, 903, 043
1951	22, 538, 739
1952	23, 874, 408
1953	37, 306, 341
1954	42, 544, 795

The mine produced and the mill treated 8,709,900 tons of ore during 1954, an average of about 27,500 tons per working day. This was the largest production from any single underground mine in North America. Regular grade ore was drawn approximately half from the Phillipson Level and half from the Storke Level. All low grade ore was produced from the Phillipson Level.

Sales during the year amounted to slightly over 46,000,000 pounds of molybdenum contained in all forms. Even though new markets are being developed, the iron and steel industry remains our dominant industrial customer. The rated capacity of the steel industry has increased by about 7 percent since 1953 to almost 126,000,000 tons, although only about 88,000,000 tons were produced in 1954. Demand for molybdenum in this market should continue to grow with steel production as well as with new developments in alloy steels.

Production of byproduct tungsten in 1954 amounted to 632,000 pounds contained in concentrate as compared with 413,000 pounds in 1953. This increase resulted from an improved utilization of existing plant facilities which permitted the treatment of a tonnage of tailings greater than was thought possible a year ago. Some improvement in recoveries was attained and research to discover means of further increasing recoveries is being continued.

During the past four years we have been engaged in greatly expanding the capacities of both mine and mill at a cost of almost $35,000,000.

Our ore in place but not prepared is adequate for decades of production. At the beginning of 1951, however, our actual broken and prepared ore reserves amounted to only about 14,000,000 tons. This was sufficient to support a production of about 14,000 tons per day. As explained at length in the 1951 Annual Report, we require roughly 1,000,000 tons of broken and prepared ore to support each 1,000 tons of daily production. With sights set on an eventual production of 25,000 tons per day, it became necessary not only to develop a new ton of ore for each ton being currently mined, but to prepare ahead and in excess thereof some 11,000,000 tons of broken and prepared ore.

The mill and townsite expansion programs have been completed; indeed the low grade 5,000 ton per day mill unit operated continuously throughout 1954. Total mill capacity has been increased from 15,000 to over 27,000 tons per working day.

Production of gold, silver, copper, lead, and zinc in Lake County decreased markedly in quantity and value in 1954, as in 1953. Resurrection Mining Co., a large, steady producer since 1942, discontinued its operation of the Resurrection group of mines on July 3, 1953, and reduced the number of employees from 200 to 20. The company leased portions of its mines to individuals and continued to operate its mill as a custom mill to treat the ore mined by the leasers and others. During 1954 the company continued to operate its mill on custom ore, on ore produced from the development of its new mine (Helena, in Iowa Gulch), and on old tailing-pond material from previous operations at the mill.

The Jones Lead-Zinc Mines Co. operated the Cora (Garibaldi Lease) mine throughout the first 4 months of 1954 on a sublease and produced a substantial quantity of lead-zinc ore. The DBA Kaiser Lease, among the leading producers in the county, leased the Tucson mine from the Resurrection Mining Co. and produced moderate quantities of lead and lead-zinc ore, which was milled at the Resurrection mill.

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The Arkansas Valley smelter of the American Smelting & Refining Co. purchased ores and concentrates of gold, silver, copper, and lead from various Colorado mining districts and concentrates, residues from zinc smelters, and other material from outside the State. It also resmelted lead slag from its dump to recover a substantial quantity of silver and lead.

Nonmetallics played only a small part in the mineral industry of the county. Pyrite concentrate was recovered as a byproduct in treating molybdenum ore and shipped to a sulfuric-acid plant at Denver. McMillon Construction Co., engaged in a highway project for the State highway department, produced a small quantity of paving gravel, and the Pineview Placer was operated by the Standard Fire Brick Co., which shipped sandstone (quartzite) to its Pueblo plant for manufacture in refractory brick.

La Plata.—The Vanadium Corp. of America operated its plant at Durango, producing uranium and vanadium concentrates. In June a contract was signed with the AEC to expand the plant capacity. A large share of the ore treated came from the company-owned Monument No. 2 mine in Arizona. In the La Plata district many of the old mines and dumps were examined for indications of uranium, with generally discouraging results; however, several new prospects were located in the area.

The Zodomok Mines, Inc., shipped 113 short tons of gold ore from the Bessie G mine 18 miles northwest of Durango; the ore contained 558 fine ounces of gold and 428 ounces of silver. A mill for treating the ore by amalgamation and gravity concentration was completed during 1954 but had not been placed in operation by the end of the season. The mine must be closed during the winter months owing to the heavy snowfall in the area.

Sand and gravel was reported produced for the Colorado Highway Department by Brown Construction Co., Northwestern Engineering Co., and J. H.–N. M. Monaghan & Associated Cos., as well as a small quantity of commercial structural sand and paving gravel for local building purposes. Twelve hundred tons of crushed miscellaneous stone used in concrete aggregate was produced by Burnett Construction Co.

Larimer.—Except for some beryl and petroleum sales, nonmetallics furnished the bulk of value of mineral output by the mineral industries of the county. Cement led the list of important minerals, in terms of value, followed by stone, petroleum, sand and gravel, gypsum, clays, and feldspar. The sales of all commodities showed gains, except for sand and gravel, which declined, and the total value for the county in 1954 increased 16 percent compared with 1953.

Ideal Cement Co. operated its dry-process plant at Boettcher during 1954 at optimum capacity, and shipments increased 15 percent over 1953. The plant, rated at 1.2 million tons per year, consumed 34.2 million kilowatt-hours of electrical energy in operating two 175-foot kilns and other plant facilities. Types I, II, and III, oil-well, waterproof, and masonry cement were produced and, in addition to supplying the Colorado market, the company made shipments to points in Iowa, Minnesota, Nebraska, Nevada, and Wyoming.

Crushed limestone quarried by Ideal Cement Co. at its LaPorte quarry and Frank H. Norberg Co. at the Rex quarry led the list

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of most important stones produced during 1954. Dimension and crushed sandstone were the second most important stones, followed by dimension granite and some Government-and-contractor crushed sandstone. Although some commercial structural and paving sand and gravel was sold to local building contractors, the bulk of the output resulted from highway contracts let by State and county highway departments and the Federal Bureau of Public Roads and Reclamation. Of the 349,000 tons produced in 1954, 246,000 tons was used for highway construction and maintenance; L. J. Hesser and Peter Kiewit Sons Co. were the major contractors.

The demand for gypsum as a raw material in manufacturing cement continued to climb, and the output of this mineral commodity increased slightly over 1953. E. W. Munroe continued to operate his Goodwin quarry, and a large tonnage of gypsum was also mined by the United States Gypsum Co. at its Loveland quarry and used in manufacturing plaster products.

Miscellaneous clay was quarried by Ideal Cement Co. and used in manufacturing cement. The Fort Collins Brick & Tile Co. discontinued mining operations in 1954 and purchased its clay for brick requirements.

The Gracie and U. P. feldspar mines were worked in 1954 by M. E. Johnson; the crude material was shipped to Denver for processing.

Beryl was produced by Paul Baldwin from the Green Mountain Lode and by H. A. Snyder from the Emerald Gem mine and sold to the Beryl Ores Co. in 1954.

Las Animas.—The mineral economy of Las Animas County was based almost entirely on the mining of coking coal for the Pueblo steel mills. Three mines—the Allen, Frederick, and Morley—operated by Colorado Fuel & Iron Corp. supplied 95 percent of the county output, and 24 smaller mines supplied the remainder. Approximately 1,250 men were employed mining coal in 1954.

Sand and gravel provided the bulk of the nonmetallic income to the mineral industry of Las Animas County during 1954. The Domenic Leone Construction Co. used 517,000 tons on a highway contract let by the State highway department, and the remaining 18,000 tons of paving gravel was quarried by construction and maintenance crews of the county highway department.

A small quantity of fire clay was mined by the Trinidad Brick & Tile Co. for use in manufacturing building brick and other structural clay products. The Scott-Ruiz Coal Co. also recovered a limited quantity of fire clay in its coal-mining operations. The Colorado Alabaster Lamp Mfg. Co. produced 1 ton of alabaster for ornamental uses.

Logan.—Increased production of petroleum and sand and gravel added $8 million to the valuation of the county mineral output; 99 percent came from petroleum. Logan County was the State's second largest producer of crude oil, with production from 40 fields. Four fields—Northwest Graylin, Yenter, Lewis Creek, and Mount Hope—supplied half of the county's 8.1 million barrels. In exploration and development activities, the county was second only to Morgan County and had 157 wildcat and 237 development wells completed. Oil production was reported from 13 new fields, 4 of

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which supplied ½ million barrels; the fields were the East Mount Hope, Dune Ridge, Liberty, and West Minto.

Mesa.—Mesa was one of the State's important uranium-producing counties. Fifty-eight uranium mines were reported active, in development, or in actual production; most of these were in the Calamity Mesa and Outlaw Mesa areas. Ore was shipped primarily to the Climax Uranium Co. mill at Grand Junction, which recovered both uranium and vanadium concentrates. During the year Climax and the AEC signed a contract for doubling the plant capacity. This expansion, according to Climax, will cost $2.5 million and will be completed in the fall of 1955.

Sand and gravel was the most valuable mineral commodity (excluding uranium) produced in the county during 1954. Structural and paving gravel and structural sand were sold by the Whitewater Sand & Gravel Co., and the Grand Junction Brick Co. mined a small quantity of miscellaneous clay for use in its brick plant.

Mineral.—The output of gold, silver, copper, lead, and zinc from Mineral County in 1954 gained 34 percent over 1953 because of increased activity by the Emperius Mining Co. That company produced the bulk of the minerals in the county, as it has for the past 14 years, from the group of mines at Creede, which included the Amethyst, Commodore-Wedge, New York-Volunteer-Del Monte-Aspen, and Equinox properties. Two other metal producers in the county were Jackson Mining Co., operating the Holy Moses group, and Outlet Mining Co., operating the Phoenix-Palo Alto group.

The sand and gravel produced in Mineral County in 1954 resulted from activities of the Alger Construction Co., which was engaged on a State highway department project and from quarrying operations of the county highway department.

Moffat.— Moffat County produced petroleum, coal, and sand and gravel, in that order of value. Petroleum, accounting for 85 percent of the total output, was produced from 10 fields. The Iles, Powder Wash, Hiawatha, and Maudlin Gulch fields supplied seven-eighths of the county output. Three new producing fields—Ace, Danforth Hills, and Sugar Loaf—had supplied 33,000 barrels of crude by the year end.

The county's two oil discoveries were made by The Texas Co. One was the Danforth Hills field, with production from the Morrison formation, and the second was development of production from the Shinarump formation at Moffat dome. A gas discovery was made by Quintana Production Co. in the Mesa Verde formation at Slater dome.

Montezuma.—In 1954 the total mineral output was petroleum from the Dove Creek field. In addition, 500 tons of coal was mined, and carbon dioxide, for which no breakdown of the State total is available, was produced from the McElmo field.

Montrose.—Montrose County was important for its uranium production. There were 106 uranium mines during the year, and many of them produced and shipped ore; others were still in the development stage. The Bull Canyon, Monogram Mesa, and Long Park districts were the major centers of activity. The two uranium-vanadium processing plants at Uravan (United States Vanadium Co.) and at Naturita (Vanadium Corp. of America) operated during the year. In November the Vanadium Corp. of America signed a contract with the AEC to expand the capacity of the Naturita mill.

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The Golden Cycle Corp. completed the 640-foot Bowen shaft at Atkinson Mesa near Uravan early in the year and in April began producing uranium-vanadium ores. The Bowen shaft was the deepest uranium shaft on the Colorado Plateau at the end of 1954. On Club Mesa the Shattuck Denn Mining Co. completed a 515-foot, 2-compartment shaft and began shipments.

Contractors for the Colorado Highway Department, Hunt Construction Co., Alger Construction Co., and Schmidt Construction Co. were responsible for the 111,000 tons of paving gravel produced in Montrose County in 1954.

Small quantities of gold and silver were recovered by small-scale hand placer-mining methods by Patrick McKannan from the Pinion Placer mine on San Miguel River 5 miles east of Nucla. Virl Brock mined copper ore from the Cliff Dweller and Rainbow properties and shipped it to the smelter for direct smelting to recover the contained gold, silver, and copper.

Morgan.—Morgan County was the center of the State oil exploration and development activities in 1954, with 445 wells completed. The astonishingly rapid growth of the Adena field was responsible for the activity. Adena was discovered in 1953 and had produced only 26,000 barrels by the end of that year. In 1954 the field produced 4.5 million barrels of 40° gravity crude and became the State's second largest field. In addition to starting a surge of exploration activity in the area, the record of the Adena field did much to belie the reputation of the Denver-Julesburg Basin for having small and hard-to-develop fields.

Those engaged in developing the Adena field are too numerous to mention, but Lion Oil Co. and Pure Oil Co. did over half of the development drilling. Other developers included British-American Oil Producing Co., Petroleum, Inc., United States Smelting, Refining & Mining Co., Chittim & Allerdyce, S. D. Johnson, and Baumgartner & Gaddis.

Ouray.—The King Lease, Inc., at the Camp Bird mine, the principal producer of metals in Ouray County since the mine was reopened by Joseph King in 1926, was active throughout 1954. More lead-zinc ore was mined and milled in 1954 (54,640 short tons) than in 1953 (52,686 tons), but the quantity of metals contained in the ore in 1954 (2,781 fine ounces of gold, 80,973 fine ounces of silver, 603,730 pounds of copper, 2,329,719 pounds of lead, and 1,617,243 pounds of zinc) was less than in 1953 (3,658 fine ounces of gold, 107,485 fine ounces of silver, 633,578 pounds of copper, 2,987,066 pounds of lead, and 2,511,592 pounds of zinc).

Three mines—Red Mountain, Patsy, and National Belle—were operated in the Red Mountain district in 1954, and the lead and copper ore produced was shipped for direct smelting. Lead ore mined from the Mineral Farm group by Pecchio & Calhoon Lease and a cleanup of ore around a railroad loading dock by Martin Connors and Jack Clark composed the mineral production in the Uncompahgre district of Ouray County in 1954.

The 1,000-ton-per-day mill of the Idarado Mining Co. at the portal of the Treasury Tunnel near Red Mountain Pass in Ouray County operated on ore mined from company properties in San Miguel County.

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Park.—The Buckskin Joe Mines, Ltd., the principal producer of gold, silver, copper, lead, and zinc in Park County in 1954, mined zinc ore from the Phillips group of mines in Buckskin Gulch near Alma and shipped it to the Resurrection mill at Leadville for concentration. The output of ore from the mine dropped from 2,080 tons in 1953 to 982 in 1954; the company stopped mining operations in mid-July and worked exclusively on development of ore reserves. Small tonnages of lead ore were shipped from the Camp Bird No. 1 to 4 by Warren W. Good and from the Stormy Petrel Lode by W. E. Brundage & George Spencer (partnership) in 1954. A cleanup of the Record mill was made by Charles E. Whale, and gold-silver ore was shipped from the May Allsworth mine by Everett H. Briggs.

The Colorado Highway Department let a number of highway contracts in 1954, which resulted in production of 27,000 tons of paving gravel by Harrison & Atchison Co. and Alger Construction Co.

Pitkin.—The value of the county mineral production rose markedly in 1954 as a result of sharply increased coal output. Coal composed virtually all of the county mineral output in terms of dollar value; it was produced by the Thompson Creek Coal & Coke Corp.

A small tonnage of lead ore, containing some silver in addition to lead, was mined by Herron Bros. from the Smuggler mine in the Roaring Fork district of Pitkin County in 1954. Also in this district, Mrs. Dorothy Koch-Shaw mined a few tons of ore containing gold, silver, and lead from the Dorothy Louise mine.

Uranium occurrences in limestone were reported in many of the mines of the Aspen district. Such ores were not amenable to the conventional acid-leach circuits used in uranium milling.

Pueblo.—Sand and gravel and clay were the only raw mineral commodities produced in Pueblo County during 1954. Commercial sand and gravel output composed 253,000 tons out of a total of 940,000 tons and was used by local contractors in residential and industrial construction. Contracts let by the State, county, and city highway departments resulted in production of the remaining tonnage.

Mine production of fire clay and miscellaneous clay provided employment for 35 miners, who worked 100 to 300 days during 1954. Despite the continued demand for clay for the manufacture of clay products by the building trade, the output in 1954 dropped to 68,000 tons, compared with 86,000 tons in 1953. This decline was due to the lack of deposits of clay of satisfactory grade and quantity, which necessitated curtailed production of clay products. Pueblo Clay Products Co. was the largest mine operator, and this company employed 10 men 300 days in open-pit and underground fire-clay-mining activities; 4 men operated the company plant for 273 days. The Summit Pressed Brick & Tile Co. was also active, and miscellaneous clay was mined by 4 men working 100 days in open-pit operations; 2 men worked 255 days at the brick plant. Other mine operators included Colorado Fire Clay Co., Rocky Mountain Fire Clay Co., Freeman Fire Brick Co., and Standard Fire Brick Co.

Rio Blanco.—In addition to petroleum, which formed all but a fraction of 1 percent of the county mineral output, Rio Blanco County produced small quantities of coal and sand and gravel. Oil production from the Weber, Mancos, and Shinarump horizons continued to make Rangely the leading producing field in Colorado. The county, with

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its 2 fields—Rangely and Wilson Creek—produced 55 percent of the State total—a percentage that was decreasing as new production from the Denver-Julesburg Basin and other areas continues to expand Colorado's petroleum output. The Pacific Northwest Pipe Line, which was to be constructed partly in Rio Blanco County, should offer an outlet to county natural-gas fields, which were to a large extent shut in during 1954.

Wesco Refining Co. increased the capacity of its crude-oil-skimming plant from 1,500 to 1,700 barrels per day, and the California Co. operated its natural-gasoline and cycling plant; both of the plants are at Rangely. The California Co. plant was capable of producing 670 barrels of propane, 505 barrels of butane, and 1,325 barrels of natural gasoline per day and accounted for a large part of Colorado's output of the natural-gas liquids.

Some uranium was reported shipped to processing mills at Rifle and Grand Junction.

Rio Grande.—The South Mountain Mining Co. (Frank E. Siegfried & W. I. McAtee) operated the Gold Links mine in Rio Grande County 30 days in October and November 1954, under lease from the Reynolds Morse Corp., and produced a small quantity of gold and silver. Glen L. Gates conducted a cleanup of the Little Ann mill, from which some gold was recovered.

Routt.—Coal, pumice and pumicite, petroleum, and sand and gravel, in order of value, plus small amounts of copper and silver, comprised the county mineral output.

Coal mines numbered 16 and employed approximately 390 men in 1954. Major coal mines in the county were operated by Osage Coal Co., Edna Coal Co., Colorado & Utah Coal Co., and Dunn Coal Co. The county ranked third in the State with respect to coal production and derived two-thirds of its output from strip mines.

The leading producer of pumice (scoria) in the State in 1954 was the McCoy Aggregate Co., which operated the McCoy pit and shipped scoria to manufacturers of concrete blocks and concrete-aggregate producers in the Denver area. Mine sales increased considerably during the year, despite rising costs of mining and transportation.

A small output of silver and copper in Routt County in 1954 resulted from activity at two mines—Colorado (Colorado Mining Co.) and Copper King (Grove, Giggey, & McArthur). This renewal of work may mark revival of an important mining area, because it was near Hahn's Peak that gold was discovered in 1862, opening northwest Colorado and making possible the development that followed.

Saguache.—Lead and zinc production increased considerably in Saguache County in 1954; but gold, silver, and copper output decreased, compared with 1953. Most of the lead and zinc was produced by the Costello Lease from the Rawley mine at Bonanza, although a number of other mines in the area added to the total output.

Uranium prospecting was carried out in the northwestern part of the county, and one significant discovery—the Los Ochos prospect—was made by the Thornburg Bros.

San Juan.—Because the smaller producers of lead and lead-zinc ores had limited milling facilities since the Shenandoah-Dives mill near Silverton was closed in March 1953, output of the metals, gold, silver, copper, lead, and zinc, from San Juan County dropped drastically in

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1954. Production from the Pride of the West mine by Barney Blackmore & Associates composed a large part of the metals output from the county.

San Miguel.—The value of gold, silver, copper, lead, and zinc output, which accounted for 99 percent of the value of the mineral production in San Miguel County in 1954, decreased 25 percent, compared with 1953.

The Idarado Mining Co. increased the tonnage of ore mined from the Treasury Tunnel-Black Bear-Ajax group and continued to be the important producer in the county and one of the principal producers in the State. Ore was treated in the company 800-ton-per-day mill on the Ouray County side of the divide between San Miguel and Uncompahgre River drainages. The mill products were gold-silver bullion (obtained by amalgamating a jig hutch product) and copper, lead, and zinc concentrates. The company gained control and took over the management of the Telluride Mines, Inc., Smuggler Union-Montana-Tomboy group of mines and the Pandora 900-ton-per-day flotation mill in May 1953. The entire operation was closed in February 1954 because of the depressed lead and zinc prices, but a small force of men were soon reemployed to continue underground development and repairs and to repair and improve the mill.

The Silver Bell Mines Co. operated the Carbonero mine at Old Ophir and Silver Bell mill at Ophir in the Iron Springs district throughout the year until late in the year, when all operations were closed; reports indicated that the company planned to transfer its activities to uranium mining. Tungsten (wolframite) concentrate, in prior years recovered as a byproduct of the milling operation at the Silver Bell mill, was not saved in 1954.

Bog iron ore (limonite) was produced from the Iron Springs Placer mine in 1954 by Boyd Robinson until August, when the property was purchased by C. K. Williams & Co., which operated it for the remainder of the year. The output from the deposit in 1954 was seven times that in 1953.

San Miguel was one of the important uranium-producing counties, and 67 mines were reported active in either development, or actual production. Most of the activity was concentrated in the Slick Rock and Bull Canyon areas. The Joe Dandy mine, operated by the Colorado-Utah Uranium Co., and the Georgeto mine, operated by Uranium, Inc., were considered to have major importance in terms of reserves and production.

Summit.—The Wellington mine at Breckenridge, operated without interruption by W. L. Davenport since 1947, was again in 1954 the main producer of metals in Summit County. The lead-zinc ore mined in 1954 (12,259 short tons), an increase over 1953 (11,298 tons), was shipped to a custom mill outside the county, where lead and zinc concentrates were produced, containing gold, silver, and copper, in addition to lead and zinc. Other shippers of smaller quantities of ore from the Breckenridge district were Cordillera Corp. (Ling group), Joe Gilmore (Monte Christo), and Gaymon & Webb (Pittsburg).

Small quantities of gold and silver were recovered from two small-scale, hand placer-mining operations in this district in 1954. Boss Lode placer was operated by Max Hugh Ostrander and by Ross L.

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Benson, and the Key West Lode placer was operated by Max Hugh Ostrander.

During 1954 Kyle & Thomas Mining Co. shipped lead ore containing lead, silver, and copper to the smelter from the Big Four mine in the Green Mountain district. Three metal mines were productive in the Montezuma district in 1954; Chautauqua (operated by Sally Barber Mining Co.) had the largest output, followed by Fisherman (operated by Joseph G. Bott) and Silver King (operated by Vera & John M. Jeffrey).

Teller.—The Golden Cycle Corp. continued to operate its 1,000-ton-per-day Carlton custom flotation-cyanidation mill and its Ajax group of mines in the Cripple Creek district, Teller County, in 1954. Despite the fact that the entire output of gold ore and mine dump material from the district, which came from 22 active mines in 1954 compared with 19 in 1953, was treated at the Carlton mill, its daily average of ore treated for the year was 500 tons. The mill process for treating the ore included bulk flotation concentration; roasting of the gold-pyrite concentrate in a fluosolids reactor, where the sulfur in the pyrite provides fuel for the roasting; cyanidation of the calcines from the reactor and dust collectors, with zinc-dust precipitation of the gold; and cyanidation of the flotation tailing in a low-grade circuit, using carbon precipitation.

The Ajax group of mines, operated by the Golden Cycle Corp., was the leading producer of gold in the district and in the State in 1954. The Cresson mine, operated by the Cresson Consolidated Gold Mining & Milling Co., was the second-ranking producer of gold in the district and third in the State (Treasury Tunnel-Black Bear-Ajax group of copper-lead-zinc mines, operated by Idarado Mining Co. in San Miguel County was second). The United Gold Mines Vindicator group of mines and the LeClair Consolidated Mines Co. Grace Greenwood mine were also producers of substantial quantities of gold in the district in 1954.

Output of nonmetals in Teller County consisted of stone, sand and gravel, and feldspar, but these commodities contributed only a small portion of the income to the mineral industry of the county. Dimension monumental granite was produced for the local market by the Pikes Peak Granite Co., and all production of sand and gravel resulted from contracts let by the State highway department.

Washington.—Washington County shared the growth of the petroleum industry in northeastern Colorado by producing 3.4 million barrels of crude oil in 1954, compared with 2.5 million barrels in 1953. Exploration drilling was relatively intense, and 106 wildcat wells were completed with 8 oil and 3 gas discoveries; additionally, 75 development wells were completed. Production came from 13 fields, 8 of which were new in 1954. The Bobcat and Big Beaver were the most outstanding of the new producing fields and accounted for three-quarters of the county's increase.

The Bobcat field was discovered by Continental Oil Co.; and this company, along with Skelly Oil Co., was primarily responsible for developing the field. The Big Beaver field was discovered by the New Drilling Co. with Continental Oil Co. and Stanolind Oil & Gas Co. carrying out most of the development work.

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Weld.—Petroleum, coal, and sand and gravel were produced in Weld County, which ranked fifth in petroleum production and second in coal production.

Crude-petroleum output more than doubled in 1954, with growth of the Black Hollow, Battle Canyon, and Masters fields. The Black Hollow field was developed solely by the California Co.; Shell Oil Co. was primarily responsible for the development drilling in the Battle Canyon field.

Fourteen fields produced oil in 1954, three of which, South Greasewood, Spurgin, and White Butte, were discovered in that year.

The coal-mining industry supplied employment to approximately 370 men at 8 operations in Weld County. Major producers were the Imperial Coal Co., the Clayton Coal Co., and the Boulder Valley Coal Co., which together operated five mines; other operators were the McNeil Coal Corp., the Graden Coal Co., and the Shamrock Coal Co.

The bulk of the sand and gravel produced in Weld County was Government-and-contractor output and was used in highway projects under supervision of the Colorado Highway Department.

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The Mineral Industry of Connecticut

By Robert D. Thomson[1]

MINERAL production in Connecticut in 1954, which consisted mainly of nonmetallic minerals, was valued at $9,581,000, an increase of 22 percent over 1953. The gain in value of output largely resulted from the 84-percent increase in sand and gravel production because of increased coverage of the industry. Mica was the only other mineral product showing increased production; all others dropped. Sand and gravel replaced stone in 1954 as the principal mineral product in the State. Production in 1954 was reported in all 8 counties; New Haven, Hartford, and Litchfield each had over $1 million in mineral production.

Some production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

TABLE 1.—Mineral production in Connecticut, 1953–54[1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Beryllium concentrate	33	$14,321	13	$7,976
Clays	438,200	448,260	288,807	284,652
Feldspar long tons	9,829	63,049	9,280	60,463
Peat	7,475	30,450	5,856	23,724
Sand and gravel	3,025,840	2,347,750	4,846,282	4,314,557
Stone	[2] 2,826,568	[2] 4,235,327	[2] 2,829,198	[2] 4,269,430
Undistributed: Columbium-tantalum ore (1953), lime, mica, and stone (dimension basalt, 1953)		778,303		620,099
Total Connecticut		7,917,000		[3] 9,581,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes limestone for lime (1953) and certain stones, value for which is included with "Undistributed."
[3] The total has been adjusted to eliminate duplication in the value of stone used in the manufacture of lime.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Eight companies mined miscellaneous clay in Connecticut during 1954. Output showed a 34-percent drop in tonnage and a 36-percent drop in value compared with 1953. Except for one company, the operations were wholly captive.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

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Feldspar.—Crude feldspar was produced by open-pit methods by Eureka Mica Mining & Milling Co., Inc., and the Worth Spar Co. in 1954. Output decreased slightly in 1954 compared with 1953, but the average price paid for crude feldspar increased from $6.41 to $6.52 per ton. Both companies operated dry grinding plants and sold ground feldspar, mainly to the pottery and porcelain industries.

Lime.—New England Lime Co. at its Canaan plant continued to be the only producer of lime in Connecticut. Both quicklime and hydrated lime were produced and marketed as building lime, agricultural lime, and chemical lime. Raw material for the Canaan plant was produced from a quarry near the plant.

Mica.—Total crude mica mined in Connecticut in 1954 was 164 and 250 percent, respectively, above the tonnage and value produced in 1953, mainly because of increased sales to the Government. Both sheet and scrap mica were sold in 1954. All of the sheet mica (except for a quantity of punch mica) was sold to the General Services Administration (GSA), Materials Service Depot, Franklin, N. H. Most of the sheet and scrap mica came from four mines in the northwest corner of Middlesex County near Portland. The punch mica, which was sold to industry, and all the scrap mica were shipped out of the State for further processing.

Sand and Gravel.—In 1954 sand and gravel was Connecticut's principal mineral product, representing 45 percent of the value of mineral production. Increased private and public construction in Connecticut provided greater local markets for sand and gravel, with output increasing 60 percent in tonnage and 84 percent in value compared with 1953 mainly because of increased coverage of the industry. Of the sand and gravel production, the building industry consumed 43 percent of the tonnage (52 percent of the total value) and the paving industry 52 percent (42 percent of the total value).

Sand and gavel was mined in every county in 1954, and 53 commercial operators were active during the year. Forty-seven of the companies produced sand, and 51 companies produced gravel. Of the sand producers, 37 marketed structural sand, 29 paving sand, and 2 filter sand. Thirty-seven of the 51 gravel producers sold structural gravel and 24 sold paving gravel.

Stone.—Connecticut stone production remained virtually the same in 1954 as in 1953. The figures, however, are not comparable. Previous to 1954 limestone used in the manufacture of lime was excluded as part of the State's stone production. Limestone, basalt, quartz, and granite, in order of decreasing importance, were mined by open-pit methods. Both dimension and crushed stone were produced in 1954 with crushed stone representing 96 percent of the total value. The Connecticut Agstone Co., the Conklin Limestone Co., Inc., New England Lime Co., and United States Gypsum Co. operated limestone mines and crushing plants in Fairfield and Litchfield Counties; and Connecticut Agstone Co., in addition, produced dimension limestone for rough construction use. Six companies in Hartford County, 1 company in Litchfield, and 5 companies in New Haven produced crushed basalt, mainly as concrete and road metal. Quarries in New Haven, New London, and Windham yielded dimension and crushed granite. Lantern Hill Silica Co. was the only producer of silica (quartz) and sold it mainly to the glass industry.

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TABLE 2.—Sand and gravel sold or used by producers, 1953–54, by classes of operations and uses

Uses	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Commercial operations:						
Sand:						
Building	824,572	$705,856	$0.86	1,220,105	$1,135,119	$0.93
Paving	476,004	391,690	.82	777,120	736,727	.95
Engine	1,375	550	.40	(1)	(1)	
Other	13,460	8,962	.67	(1)	(1)	
Gravel:						
Building	482,642	557,497	1.16	863,410	1,102,090	1.28
Paving	438,890	414,461	.94	694,015	780,833	1.13
Other	42,553	13,242	.31	189,038	215,951	1.14
Undistributed [2]	62,918	69,628	1.11	49,889	44,045	.88
Total commercial sand and gravel	2,342,414	2,161,886	.92	3,793,577	4,014,765	1.06
Government-and-contractor operations:						
Sand: Paving	576,700	149,506	.26	112,280	16,676	.15
Gravel:						
Building				330	99	.30
Paving	105,726	36,358	.34	940,095	283,017	.30
Total Government-and-contractor sand and gravel	683,426	185,864	.27	1,052,705	299,792	.28
Grand total	3,025,840	2,347,750	.78	4,846,282	4,314,557	.89

[1] Included with "Undistributed" to avoid disclosure of individual operations.
[2] Includes molding sand, grinding and polishing sand (1954), filter sand, other sand (1954), and railroad ballast (gravel).

TABLE 3.—Stone sold or used by producers, 1953–54 by uses

Use	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Dimension stone:				
Building stone:				
Rough construction	[1] 2,287	[1] $8,831	2,081	$24,186
Cut stone, slabs, and mill blocks, cubic feet	[2] 26,266	[2] 78,927	[2] 21,725	[2] 61,332
Monumental stone do	[2] 10,680	[2] 84,380	[2] 6,000	[2] 42,000
Curbing and flagging do	(3)	(3)	3,831	11,417
Undistributed [4]	1,424	35,033	1,378	30,442
Total dimension stone (quantities approximate in short tons)	[1] 6,776	[1] 207,171	6,078	169,377
Crushed and broken stone:				
Riprap	[2] 33,918	[2] 40,414	12,491	18,444
Concrete roadstone, railroad ballast	2,635,053	3,532,045	2,669,717	3,589,999
Undistributed [5]	[6] 150,821	[6] 455,697	140,912	491,610
Total crushed and broken stone	2,819,792	4,028,156	2,823,120	4,100,053
Grand total	[7] 2,826,568	[7] 4,235,327	[7] 2,829,198	[7] 4,269,430

[1] Incomplete total.
[2] Incomplete data, portion not included is combined with "Undistributed."
[3] Included with "Undistributed."
[4] Includes rough architectural, rubble, dressed monumental, curbing and flagging (1953).
[5] Includes riprap (1953) agricultural limestone, furnace flux, and other crushed and broken stone.
[6] Excludes limestone used in the manufacture of lime.
[7] Excludes limestone for lime (1953), dimension basalt (1953), and quartz.

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METALS

Beryl.—Production of beryl in 1954 decreased in tonnage and value compared with 1953. The entire 1954 production was sold to the Government. Most of the beryl was purchased by the GSA, Materials Service Depot at Franklin, N. H., while a small quantity was bought at the Spruce Pine, N. C., Depot. Beryl was mined in Fairfield, Litchfield, Middlesex, and New Haven Counties.

Columbium-Tantalum.—Small quantities of columbite-tantalite were produced in 1954; the entire production was sold to the Government.

MINERAL FUELS

Peat.—Production of peat in Connecticut decreased 22 percent in tonnage and value in 1954 compared with 1953. The peat was recovered from bogs in Hartford, Middlesex, Tolland, and Windham Counties and was marketed mainly for agricultural purposes.

REVIEW BY COUNTIES

Fairfield.—Minerals produced in Fairfield County in 1954 were stone, sand and gravel, and beryl. Sand and gravel, the leading mineral commodity, was produced by six companies along the Long Island Sound coastline and inland near New Canaan, Weston, and Bethel. Bernard J. Dolan Co. and The Iron Ledge Co. produced structural sand; John Lomazzo & Sons and Norwalk Sand & Gravel Corp. produced structural and paving sand, but Peter B. German produced paving sand only. Structural gravel was produced by Bernard J. Dolan Co., The Iron Ledge Co., Norwalk Sand & Gravel Co., and Peter B. German; and paving gravel by John Lomazzo & Sons, Peter B. German, and Charles J. Hvolbeck & Co. Ralph L. Vick sold bank-run sand from a pit near New Canaan for miscellaneous uses. The Connecticut Agstone Co. continued to operate its Danbury limestone open pit and crushing plant. Crushed limestone was sold for agricultural purposes, asphalt and concrete use and as flux and a small quantity was marketed as rough dimension stone for construction purposes. Beryl was produced at the Casey mine, Ridgefield, by Homer Hise.

Hartford.—In 1954 Hartford County ranked first in value of clays and peat produced and second in stone, sand and gravel, and State total mineral output. The total value of mineral production was $3 million, an 18-percent increase over 1953. Miscellaneous clays for heavy clay products were produced from open pits by Edward W. Mack & Son, Windsor; Kelsey Ferguson Brick Co., Suffield; Donnelly Brick Co., Kensington; Stiles & Reynolds Brick Co., Berlin; and The Eastern Brick Co., Berlin and South Windsor. Crushed basalt was produced by Arborio & Sons, Inc., Farmington; The Edward Balf Co., Newington; Material Services, Inc., East Grandy; Sherman Sand & Stone Co. and New Haven Trap Rock Co., Plainville; and Angelo Tomasso, Inc., New Britain, for use in concrete and as road material and screenings. In addition, New Haven Trap Rock Co. sold riprap. Thirteen companies produced sand and gravel for structural, paving,

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TABLE 4.—Value of mineral production in Connecticut, 1953–54, by counties

County	1953	1954	Minerals produced in 1954 in order of value
Fairfield	$523,642	$798,571	Sand and gravel, stone, beryllium.
Hartford	2,823,628	3,079,062	Stone, sand and gravel, clays, peat.
Litchfield	1,223,524	1,183,350	Stone, lime, sand and gravel, beryllium.
Middlesex	324,991	265,596	Sand and gravel, feldspar, mica, clays, peat, beryllium.
New Haven	2,408,184	3,375,513	Stone, sand and gravel, clays, beryllium.
New London	599,427	619,023	Stone, sand and gravel.
Tolland	(1)	(1)	Sand and gravel, peat.
Windham	(1)	(1)	Sand and gravel, stone.
Undistributed [2]	13,787	259,786	
Total	7,917,000	9,581,000	

[1] Included with "Undistributed."
[2] Includes counties whose value must be concealed for particular years as indicated by footnote 1 and a quantity unspecified by county.

grinding, and filter purposes in 1954. The 10 leading companies were Dunning Sand & Gravel Co., Farmington; Russak Bros., Inc., Plainville; Farmington Sand & Gravel Co., West Hartford; Manchester Sand & Gravel Co., Manchester; Sherman Sand & Stone Co., Plainville; General Sand & Stone Corp., Bristol; Angelo Tomasso, Inc., Plainville; Certified Sand Co., Rocky Hill; The Alexander Jarvis Co., Manchester; and Lake Garda Sand & Gravel Corp., Unionville.

Litchfield.—Litchfield County continued to rank third in Connecticut in total value of mineral output, producing stone, lime, sand and gravel, and beryl. Crushed basalt was produced by Woodbury Trap Rock Co., Inc., Woodbury. United States Gypsum Co., Falls Village; New England Lime Co., Canaan; and The Conklin Limestone Co., Inc., Canaan, quarried and crushed limestone. Quicklime and hydrated lime were produced at its New England Lime Co. Canaan plant for sale to the chemical and processing industries. Sand and gravel was produced by State Line Sand & Gravel Co., Inc., MacKenzie & Carlson, Inc., The Lime Rock Sand & Gravel Co., Inc., Benvenuti & Favali Construction Co., Inc., John C. Iffland Lumber Co., and Johnson Sand & Gravel Co. More of the processed sand and gravel was sold as structural material than for paving use. Howard J. Hewitt produced beryl from the Merryall mine near New Milford.

Middlesex.—Mineral production in 1954 in Middlesex County decreased slightly below that in 1953 and consisted of sand and gravel, feldspar, mica, clays, beryl, and peat, in order of decreasing importance. Butler's Sand Service, Lindemark's Sand Service, and Sebastian Ortisi produced structural sand and gravel in the vicinity of Portland. Shore Line Washed Sand & Stone Co., Inc., operated sand pits for producing structural and paving sand and gravel pits near Killingworth for paving material. Bugg & Heser, Clinton, sold washed gravel as paving material.

Soda-type feldspar was mined by the Worth Spar Co. and ground at its Cobalt plant for use in cleaning compounds. Eureka Mica Mining & Milling Co., Inc., operated an open pit and dry-grinding plant at Portland, selling the ground feldspar to the pottery industry. Seven firms produced crude mica in 1954. Lewie Aldridge, J. W. Nance, and Strafford Mines, Inc., operated the Strickland mine, Portland, at various times in 1954 and processed the crude mica into full-trimmed mica for sale to the GSA purchasing depot at Franklin,

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N. H. Maurice DeLuca produced and processed crude mica from the Polly Lot, East Hampton, for sale to the Government as full-trimmed mica. Crude mica also was produced by the Worth-Spar Co., Worth Spar mine, Cobalt; Harry E. Leach, Tollgate mine, Middletown; and Homer Hise, Strickland and Tollgate mines, and was processed for sale to the Government as hand-cobbed mica. In addition to the sheet mica, Harry E. Leach sold a small quantity of scrap mica and beryl. Beryl also was produced by Natural Gem & Mining Co. and International Minerals & Chemical Corp. Miscellaneous clay was mined and used by the Michael Kane Brick Co., Middletown, in the manufacture of building brick.

New Haven.—New Haven County ranked first in mineral production in 1954, accounting for 35 percent of the State's total value of mineral output. Stone, representing 53 percent of the total county value, was produced by the following companies: C. W. Blakeslee & Sons, Inc., Pine Rock; A. N. Farnham, Inc., Pine Rock; Foxon Trap Rock Co., Inc., New Haven; New Haven Trap Rock Co., North Branford and Wallingford; York Hill Trap Rock Quarry Co., Meriden; Ansonia Granite Quarries, Seymour; and Stony Creek Granite Quarries, Inc., Branford. The first 5 companies produced crushed basalt, while the last 2 quarried dimension granite. Sixteen companies produced sand and gravel, of which Bear Sand & Gravel, Inc., Waterbury Sand & Gravel Co., A. N. Farnham, Inc., Estate of Stillman H. Rice, Meriden, Washed Sand & Stone Co., Inc., Grasso Construction Co., D. J. Carten Sand & Gravel Co., Colonial Sand Gravel Co., Elm City Construction Co., and The Seymour Sand & Stone Co. were the principal 10 firms. Miscellaneous clay was mined by Connecticut Brick Co. and North Haven Brick Co. from pits near Hamden for use in the manufacture of brick. Burritt R. Curtis produced beryl from the Southford quarry near Southbury.

New London.—Stone and sand and gravel were the only mineral commodities produced in New London County in 1954. John J. Doyle Sand & Gravel Co., Inc., Montville; New London Sand & Gravel Co., Inc., Waterford; and Southern New England Contractors Supply Co., New London, produced sand and gravel as structural materials and paving sand. In addition, New London Sand & Gravel Co., Inc., produced paving gravel. Dimension granite was quarried by Golden Pink Granite Quarry Co., E. L. Locarno & Sons, and Millstone Granite Quarry, Inc. Lantern Hill Silica Co. continued to produce crushed silica rock, mainly for use in manufacturing glass.

Tolland.—Sand and gravel and peat were the only minerals produced in 1954 in Tolland County. The entire sand and gravel output was sold as bank-run material by Myron Lee near Bolton.

Windham.—Mineral production in Windham County in 1954 consisted of sand and gravel, stone, and peat. R. B. Marriott & Sons operated a quarry at Oneco and produced granite for use as rubble, curbing, flagging, and rough construction stone. Dunning Sand & Gravel Co., Wauregan, and R. A. Rawson Sand & Gravel, Putnam, produced both sand and gravel, while Alexander Jarvis Co. produced only gravel.

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The Mineral Industry of Delaware

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, United States Department of the Interior, and the Delaware Geological Survey.

By Robert D. Thomson [1]

MINERAL PRODUCTION in Delaware in 1954 was valued at $947,000, a 44-percent increase over 1953. Some production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage. Substantial gains were made in the Delaware total value of stone and sand and gravel production, while clay declined. Sand and gravel continued to be the principal mineral products, supplying 79 percent of the total value. In 1954, 11 companies reported production from 3 counties, compared with 7 companies from 2 counties in 1953.

TABLE 1.—Mineral production in Delaware, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Sand and gravel	520,817	$399,685	971,647	$752,528
Stone	80,364	215,382	(2)	(2)
Undistributed: Nonmetallic minerals and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2)		43,930		194,706
Total Delaware		659,000		947,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Value included with "Undistributed."

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Miscellaneous clays decreased both in tonnage and value in 1954 compared with 1953. Two companies produced miscellaneous clays from open-pit mines for use in manufacturing building brick.

Sand and Gravel.—Sand and gravel production continued to be the principal mineral industry in Delaware, with output increasing 87

[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

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percent in tonnage and 88 percent in value in 1954, compared with 1953. More complete coverage of the industry contributed to the apparent rise in production in 1954. A 5-percent rise in public and private construction, however, also contributed to the increase. Ten companies reported production of sand and gravel in 1954 compared with only 4 in 1953; of these, 6 produced structural and paving sand, 4 structural gravel, and 1 engine sand. Small tonnages were produced by the Delaware State Highway Department as paving material.

Stone.—Petrillo Bros., Inc., was the only stone producer in 1954, with production declining slightly. The crushed stone was sold for use as concrete aggregate and road material.

REVIEW BY COUNTIES

Kent.—Clays and sand and gravel were mined in Kent County during 1954. Clays were produced and used by J. H. Wilkerson & Son at Milford for manufacturing building brick. Clough & Caulk Sand & Gravel Co. operated an open pit and fixed plant at Wyoming. The sand and gravel was sold for construction purposes. Paving sand and gravel was produced by St. Jones River Gravel Co. from a bank near Dover.

New Castle.—Eighty-three percent of the total value of mineral production in the State in 1954 came from New Castle County. Sand and gravel, stone, and clays, in order of decreasing value, were produced. Petrillo Bros., Inc., and Whittington's Sand & Gravel Co. produced sand for structural purposes and gravel as a paving material. Delaware Sand & Gravel Co. produced paving sand and structural sand and gravel, while Parkway Gravel, Inc., only produced paving gravel. Petrillo Bros., Inc., and Parkway Gravel, Inc., each operated a pit and fixed plant at Minquadale, Whittington's Sand & Gravel Co. at Bear, and Delaware Sand & Gravel Co. at New Castle. Petrillo Bros., Inc., also operated the Shellpot quarry near Wilmington. Miscellaneous clays were produced by Delaware Brick Co. for use at its New Castle building brick plant.

Sussex.—Mineral production in 1954 consisted of sand and gravel. Engine sand was mined at a pit near Lewes by Lewes Sand Co. and structural gravel near Georgetown by Melvin Joseph. J. H. Wilkerson & Son produced sand and gravel for structural use, while Adason Figgs produced sand and gravel for miscellaneous uses.

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The Mineral Industry of Florida

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Geological Survey of Florida.

By Avery H. Reed, Jr.,[1] and James L. Calver[2]

THE TOTAL mineral production of Florida in 1954 was valued at $107 million, a new alltime high and an increase of $14 million or (15 percent) over 1953, the previous high. Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences of coverage.

Contributing to the State increase of mineral production and the percentage increase in value of each over 1953 were: Cement (10), clays (including fuller's earth) (13), natural gas (45), petroleum (4), phosphate rock (14), ilmenite (4), and rutile (24).

TABLE 1.—Mineral production in Florida, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	257,911	$2,952,359	371,948	$3,337,130
Natural gas, million cubic feet	34	2,000	35	3,000
Peat	27,678	185,524	37,449	168,004
Petroleum (crude), thousand 42-gallon barrels	543	(3)	548	(3)
Phosphate rock, long tons	9,331,002	56,524,701	10,437,197	64,499,877
Sand and gravel	3,731,432	3,199,368	3,468,842	2,661,152
Stone (exclusive of dimension stone)	[2] 9,428,959	[2] 11,309,421	14,225,356	16,832,066
Titanium concentrate:				
Ilmenite	151,109	2,322,451	157,157	2,411,823
Rutile	6,475	702,791	7,305	869,677
Zirconium concentrate	21,234	793,685	17,959	820,041
Undistributed: Cement, abrasive garnet, lime, and minerals which must be concealed for particular years (indicated in appropriate column by footnote reference [3])	----------	14,343,637	----------	15,955,786
Total Florida	----------	92,336,000	----------	[4] 106,510,000

[1] Production as measured by mine shipments, sales or marketable production (including consumption by producers).
[2] Value included with "Undistributed."
[3] Excludes stone used in manufacturing cement and lime.
[4] The total has been adjusted to eliminate duplication in the value of clays and stone.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Knoxville, Tenn.
[2] Geologist, Florida Geological Survey, Tallahassee, Fla.

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Those commodities recording lower production values than in 1953 were garnet, kaolin, and sand and gravel.

Lime and peat production increased in tonnage but dropped in total value.

Zircon production, on the other hand, while recording a decrease in tonnage, had a greater total value.

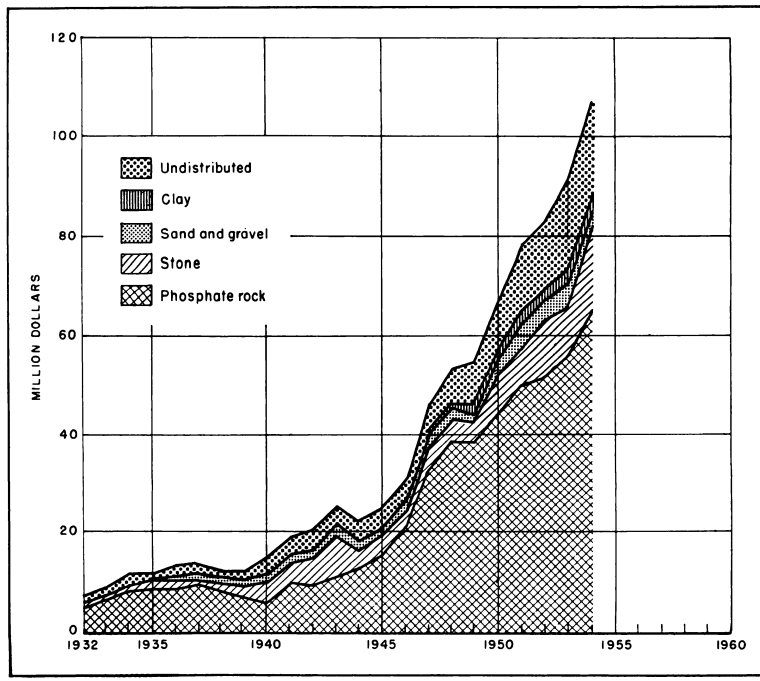

FIGURE 1.—Total value of mineral production of Florida, 1932–54.

TABLE 2.—Average unit value of mineral commodities in Florida, 1950–54 [1]

Commodity		1950	1951	1952	1953	1954
Cement, portland	376-pound barrel	$2.65	$2.80	$2.76	$2.87	$2.89
Clays:						
Fuller's earth	short ton	16.70	16.78	17.37	18.84	19.82
Kaolin	do	23.74	23.60	24.55	23.92	24.49
Miscellaneous clay	do	.75	1.00	1.00	1.00	.78
Garnet	do	-------	38.07	46.44	46.49	30.00
Ilmenite	do	15.56	14.81	16.35	15.37	15.36
Lime	do	12.55	12.56	12.93	12.57	11.97
Limestone:						
Crushed	do	1.30	1.17	1.22	1.20	1.25
Dimension	do	-------	-------	9.74	9.00	2.53
Natural gas	thousand cubic feet	.05	.07	.07	.06	.08
Peat	short ton	6.57	6.27	6.50	6.70	4.49
Petroleum	42-gallon barrel	(2)	(2)	(2)	(2)	(2)
Phosphate rock	long ton	5.61	5.92	5.88	6.07	6.18
Rutile	short ton	50.00	50.17	103.77	108.54	119.05
Sand	do	.91	.84	.75	.82	.71
Gravel	do	1.20	1.25	1.34	1.27	1.50
Zirconium concentrate	do	47.04	43.63	38.57	37.38	45.66

[1] For greater detail on prices by grades and markets see volume I, Minerals Yearbook, 1954.
[2] Data not available.

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REVIEW BY MINERAL COMMODITIES

METALS

Monazite.—Monazite was recovered from sand-dredging operations for titanium minerals in Duval County. Production data are classified.

Titanium (Ilmenite and Rutile Concentrates).—Titanium mineral production in 1954, as in 1953, was from Brevard, Clay, Duval, and Indian River Counties. The mineral-separation plants were in Brevard, Clay, and Duval Counties, and ore that originated in Indian River County was processed in Brevard County. Production data are based on the output of the mineral-separation plants.

The Trail Ridge mine and mineral-separation plant of E. I. du Pont de Nemours Co., Inc., are on the property of Camp Blanding, Clay County. The nearest city is Starke, in Bradford County.

The Highland mine and plant of the du Pont Co. at Lawtey, Bradford County, about 17 miles north of Starke, duplicate the Trail Ridge plant in capacity and flowsheet, except for improvements in design suggested by the 5-year operation at Trail Ridge. This plant was scheduled for production early in 1955.

The Humphreys Gold Corp. operated the Trail Ridge mine and plant for du Pont and was building the new Highland plant.

The Humphreys Gold Corp. also operated a dredging operation and concentrator for the Rutile Mining Co. of Florida near Jacksonville in Duval County. This plant was also used for concentrating material from deposits near Jacksonville, controlled by the Titanium Division of National Lead Co.

The Florida Ore Processing Co. continued to mine beach and dune sands for concentration in its separation plant near Melbourne, Brevard County.

The Crane Co., well-known plumbing and heating fixtures manufacturer, had a field party of geologists active in the State for months. Fieldwork was centered largely along the Gulf of Mexico shoreline near Panama City. The best showing, as reported by Engineering and Mining Journal,[3] was in the Seagrove Beach area about halfway between Panama City and Destin. The Crane Co. was reported preparing to extract, purify, and market rare-earth metals from monazite following extraction of thorium.[4]

A mineral-prospecting lease for a large area of submerged coastline in St. Johns, Duval, and Nassau Counties was obtained by C. E. Freeman of Jacksonville. Exploration was planned for ilmenite, monazite, zircon, and rutile.[5]

Ilmenite.—Ilmenite was produced in Brevard, Clay, and Duval Counties. The production for 1954 was 4 percent above 1953 in tonnage and value. The ilmenite mined and processed in Clay County is actually a combination of ilmenite, rutile, and leucoxene; no attempt is made to separate and recover rutile as such.

Rutile.—Rutile was produced in Brevard and Duval Counties as a byproduct recovered in preparing ilmenite concentrate. The tonnage produced increased 13 percent above 1953, and total value increased 24 percent, indicating a 10-percent increase in the unit value.

[3] Engineering and Mining Journal, Florida: Vol. 155, No. 4, April 1954, pp. 134, 136.
[4] Chemical Engineering, Crane to Jump Into Rare Earth Market: Vol. 61, No. 7, July 1954, p. 140.
[5] Rock Products, Industry News: Vol. 57, No. 6, June 1954, p. 67.

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Zirconium (Zircon Concentrate).—Zircon, like rutile, was produced as a byproduct in recovering ilmenite. The source of production was ilmenite-concentrating plants, of which there were 3—1 each in Brevard, Clay, and Duval Counties. The 1954 production fell 15 percent below 1953 in tonnage but increased 3 percent in total value, reflecting a 22-percent increase in unit value.

The technical press called attention to the growing demand for and multiple uses of zirconium chemicals made from zircon. Market growth since 1943 is reported as fourfold.[6]

NONMETALS

Cement.—The cement industry again expanded to another all time high with shipments 8 percent above the previous high of 1953 and total value up 10 percent, reflecting an average increase of 2 cents a barrel.

The Bunnell plant of Lehigh Portland Cement Co. continued to use staurolite, an iron-magnesium-aluminum silicate, recovered as a byproduct from the concentration of ilmenite, as an iron and alumina additive in the burning of cement clinker. The plant utilizes local beds of coquina shell in place of limestone.

Clays.—The clay-mining industry, including all types and uses of clays, achieved another alltime high, both in tonnage and value. The increase over 1953—the previous high—was 44 percent in volume but only 13 percent in total value, reflecting a greater increase in the production of the lower valued miscellaneous clays.

Fuller's Earth.—During the year the Attapulgus Clay Co. became the Attapulgus Division of the International Minerals & Chemical Corp., which, with the Floridin Co., continued to produce fuller's earth. Total material sold or used during 1954 was appreciably less than in 1953.

Kaolin.—The United Clay Mines Corp. and the Edgar Plastic Kaolin Co. continued to mine kaolin; production was virtually the same in tonnage but increased slightly in total value as compared with 1953.

Miscellaneous Clay.—Miscellaneous clay used for manufacturing heavy clay products and portland cement nearly doubled in tonnage and value over 1953.

Garnet, Abrasive.—Abrasive garnet was produced by one operator as in 1953, with total production and value again smaller than in the previous year.

Lime.—The production of lime increased slightly but at a small loss in total value as compared with 1953.

Limestone.—Limestone production, exclusive of dimension stone, reached a new high for the State, with a total of 14.2 million tons of crushed and broken stone valued at $16.8 million, an increase of 4.8 million tons and $5.5 million. However, the figures for 1953 and 1954 are not directly comparable because those for 1953 exclude, and those for 1954 include, limestone used in manufacturing portland cement and lime.

Production of commercial crushed and broken limestone exclusive of stone used in cement and lime in 1954 exceeded that of 1953 by

[6] Chemical Engineering, Where You Can Use Zirconium Chemical: Vol. 61, No. 3, March 1954, p. 138.

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36 percent in tonnage and 41 percent in total value. Average unit value increased 5 cents a ton.

Commercial crushed-limestone production was reported from 60 quarries in 18 counties in 1954 compared with 41 quarries in 14 counties in 1953. New counties reporting in 1954 were Collier, Pinellas, St. Johns, and Sumter. In all, 33 quarries reported production both years, 27 were added in 1954, and 8 ceased to operate before 1954.

TABLE 3.—Crushed limestone sold or used by producers, 1945–49 (average) and 1950–54 (exclusive of limestone used for cement and lime)

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	3,470,608	$4,097,991	1952	7,836,124	$9,572,575
1950	5,313,400	6,885,394	1953	9,428,959	11,309,421
1951	8,032,966	9,419,682	1954	[1] 14,225,356	[1] 16,832,066

[1] Includes stone used in manufacturing cement and lime.

Phosphate Rock.—For the first time in the history of the phosphate-rock industry in Florida, the marketable production in 1 year exceeded 10 million tons. The total of all types of rock mined was 10,437,000 long tons valued at $64,500,000. This exceeded the previous high of 1953 by 12 percent in tonnage and 14 percent in total value. The average value per ton increased 2 percent.

Land-pebble-phosphate production exceeded that in 1953 by 12 percent in volume and 14 percent in total value. The average unit value increased 13 cents.

Hard-rock-phosphate production increased 16 percent in both tonnage and value, with the unit value constant for both 1953 and 1954.

Production of soft phosphate rock was 22 percent greater in tonnage than in 1953 and 21 percent greater in total value. The average unit value, however, was 5 cents below the average of 1953.

The same operating companies and the same mines continued production of land pebble and hard rock phosphate as in 1953; the same producers also reported for both years in the soft rock field. However, three new names appear in 1954 as soft-rock producers—Globe Phosphate Co. (Sec. 22 mine), Sun Phosphate Co. (Sec. 10 mine), and Delta Phosphate Co. (Hernando mine), all in Citrus County.

After a lapse of 30 years, Armour Co. returned to mining phosphate rock. Early in the year construction was begun on a phosphate-processing plant 3 miles west of Bartow.

International Minerals & Chemical Corp. opened its new Bonnie phosphate-chemicals plant near Bartow to the press for the first time. The plant and its operation have been classified before this opening because part of the process work was the recovery of uranium compounds from phosphate rock.

Davison Chemical Corp. of Baltimore, Md., was reported to have merged with W. R. Grace & Co. of New York and will operate as Davison Chemical Co., Division of W. R. Grace & Co.[7]

[7] Oil, Paint and Drug Reporter, May 17, 1954, p. 5.

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Davison began producing sulfuric acid early in January as the first step in placing in operation (June) a new $10 million triple-superphosphate plant near Bartow. The rated daily capacity of the acid unit was 550 tons of 100-percent sulfuric acid. The superphosphate plant had a rated annual capacity of 200,000 tons.[8]

Virginia-Carolina Chemical Corp. installed an 8- by 80-foot rotary drier fired concurrently with introduction of other unusual features at its Nichols dry mill.[9]

American Cyanamid Co. was reported to have purchased 1,000 acres of phosphate land lying between Bartow and Fort Mead.[10]

TABLE 4.—Marketable production of phosphate rock, 1949–54

Year	Hard rock		Soft rock		Land pebble		Total	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
1949	32,176	$231,024	73,086	$321,388	6,590,145	$36,681,481	6,695,407	$37,233,893
1950	70,500	532,275	80,095	398,797	8,446,632	47,446,909	8,597,227	48,377,981
1951	81,600	628,320	90,339	486,424	8,039,881	47,497,248	8,211,820	48,611,992
1952	85,900	662,289	83,001	491,775	9,036,237	52,931,460	9,205,138	54,085,524
1953	68,200	537,416	76,781	474,248	9,186,021	55,513,037	9,331,002	56,524,701
1954	78,990	622,440	93,956	575,537	10,264,251	63,301,900	10,437,197	64,499,877

Sand and Gravel.—Sand and gravel production and value declined for the third consecutive year from the peak of 1951. Production in 1954 was 3.5 million tons, valued at $2.7 million, which was 7 percent in tonnage and 17 percent in total value below 1953 and 22 percent in tonnage and 38 percent in value below the peak of 1951. This corresponds to a drop in average unit value from 86 cents in 1953 to 77 cents in 1954, compared with 97 cents in 1951.

As in previous years, commercial sand composed the major portion of production (91 percent), commercial gravel was a little less than 8 percent of the total, and noncommercial sand represented the balance.

Seventeen counties reported production of commercial sand compared with 12 in 1953. The seven counties (Brevard, Hillsborough, Indian River, Lafayette, Leon, and Okaloosa) entered the list of producers in 1954, while St. Lucie, although reporting in 1953, did not in 1954.

In 1954, four counties reported gravel production. Of these, Escambia and Gadsden reported in both 1953 and 1954. Dade and Palm Beach, although reporting in 1953, did not in 1954. On the other hand, Manatee and Monroe reported gravel production in 1954 but not in 1953.

[8] Manufacturers Record, June 1954, p. 34.
[9] Hughes, C. V. O., Drying Phosphate Rock at rate of 200 T. P. H.: Rock Products, vol. 57, No. 6, June 1954, p. 76.
[10] Chemical and Engineering News, vol. 32, No. 39, Sept. 27, 1954. p. 3817.

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TABLE 5.—Phosphate rock sold or used by producers, by uses, 1953–54

	Hard rock			Soft rock		
	Long tons	P_2O_5	Value	Long tons	P_2O_5	Value
1953						
Ordinary superphosphate						
Triple superphosphate						
Nitra phosphate						
Direct application to soil				27,713	5,660	(1)
Fertilizer filler				(1)	(1)	(1)
Stock and poultry feed				48,197	9,905	(1)
Other fertilizers						
Total agricultural				75,910	15,565	$470,062
Elemental phosphorus, ferrophosphorus, and phosphoric acid	81,725	28,800	$643,993			
Phosphoric acid (wet process)						
Total industrial	81,725	28,800	643,993			
Exports						
Total sold or used	81,725	28,800	643,993	75,910	15,565	470,062
1954						
Ordinary superphosphate						
Triple superphosphate						
Nitra phosphate						
Direct application to soil				90,519	18,835	(1)
Stock and poultry feed						
Fertilizer filler						
Total agricultural				90,519	18,835	554,234
Elemental phosphorus, ferrophosphorus, and phosphoric acid	74,303	26,184	585,363			
Phosphoric acid (wet process)						
Total industrial	74,303	26,184	585,363			
Exports						
Total sold or used	74,303	26,184	585,363	90,519	18,835	554,234

See footnotes at end of table, p. 310.

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TABLE 5.—Phosphate rock sold or used by producers, by uses, 1953–54—Con.

	Land pebble			Total		
	Long tons	P_2O_5	Value	Long tons	P_2O_5	Value
1953						
Ordinary superphosphate	4,868,828	1,663,939	(1)	4,868,828	1,663,939	(1)
Triple superphosphate	927,701	311,942	(1)	927,701	311,942	(1)
Nitra phosphate	2,820	965	(1)	2,820	965	(1)
Direct application to soil	705,271	225,859	(1)	732,984	231,519	(1)
Fertilizer filler				(2)	(2)	(1)
Stock and poultry feed	91,165	30,126	(1)	139,362	40,031	(1)
Other fertilizers						(1)
Total agricultural	6,595,785	2,232,831	$39,825,123	6,671,695	2,248,396	$40,295,185
Elemental phosphorus, ferrophosphorus, and phosphoric acid	316,191	96,600	(1)	397,916	125,400	(1)
Phosphoric acid (wet process)	302,566	103,241	(1)	302,566	103,241	(1)
Total industrial	618,757	199,841	3,739,075	700,482	228,641	4,383,068
Exports	1,794,678	596,543	10,934,019	1,794,678	596,543	10,934,019
Total sold or used	9,009,220	3,029,215	54,498,217	9,166,855	3,073,580	55,612,272
1954						
Ordinary superphosphate	4,912,435	1,668,767	(1)	4,912,435	1,668,767	(1)
Triple superphosphate	1,036,406	337,293	(1)	1,036,406	337,293	(1)
Nitra phosphate	12,851	4,403	(1)	12,851	4,403	(1)
Direct application to soil	577,231	186,161	(1)	543,003	165,922	(1)
Stock and poultry feed				124,747	39,074	(1)
Fertilizer filler						
Total agricultural	6,538,923	2,196,624	40,938,820	6,629,442	2,215,459	41,493,054
Elemental phosphorus, ferrophosphorus, and phosphoric acid	622,563	198,321	(1)	696,866	224,505	(1)
Phosphoric acid (wet process)	439,056	141,789	(1)	439,056	141,789	(1)
Total industrial	1,061,619	340,110	5,626,417	1,135,922	366,294	6,211,780
Exports	1,964,987	653,207	12,325,328	1,964,987	653,207	12,325,328
Total sold or used	9,565,529	3,189,941	58,890,565	9,730,351	3,234,960	60,030,162

[1] Bureau of Mines not at liberty to publish, included in total.
[2] Included with "Direct application to soil."

The Highlands County Highway Department reported 21,600 tons of noncommercial sand valued at $10,800 from Highlands County, and the Bureau of Forestry reported 14,000 tons of noncommercial sand valued at $2,500, without designating the county source.

Production of commercial sand in 1954 was 6 percent below 1953 in tonnage and 19 percent below in total value, representing a drop of 11 cents a ton in average value.

Production of commercial gravel in 1954 was 23 percent below 1953 in tonnage but only 9 percent below in total value, representing a gain of 23 cents a ton in average value.

Noncommercial sand production increased 174 percent in tonnage and 432 percent in total value. This indicates an increase from an average value of 19 cents a ton in 1953 to 37 cents in 1954.

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TABLE 6.—Sand and gravel sold or used by producers, 1945–49 (average) and 1950–54

Year	Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	(1)	(1)	(1)	(1)	1,894,422	$1,717,609
1950	1,850,448	$1,687,713	943,417	$1,118,718	2,793,865	2,806,431
1951	2,986,862	2,512,282	1,431,711	1,788,400	4,418,573	4,300,682
1952	(2)	(2)	(2)	(2)	4,154,613	3,848,077
1953	3,386,329	2,760,410	345,103	438,958	3,731,432	3,199,368
1954	3,202,364	2,260,825	266,478	400,327	3,468,842	2,661,152

[1] Data not available.
[2] Figure withheld to avoid disclosure of individual company operations.

Staurolite.—Staurolite, recovered as a byproduct in concentrating sand dredged for producing ilmenite and rutile, was marketed principally as an iron and alumina additive in manufacturing portland cement. The amount so consumed in 1954 was roughly 21,000 tons. An increasing market was being found for this new mineral product as its potentialities become better known.

FUELS

Natural Gas.—Natural gas produced and marketed in 1954 increased 3 percent in volume and 45 percent in total value over 1953.

Peat.—While grouped under fuels, no peat produced in Florida is mined primarily as a fuel; rather it is mined and marketed for agricultural uses. The tonnage mined in 1954 was 35 percent greater than in 1953, but the total value as reported was 9 percent below 1953. This indicates a reduction of one-third in the unit value as marketed.

Petroleum.—Production of crude petroleum increased 5,000 barrels or slightly under 1 percent in 1954 compared with 1953.

Florida's second producing oil field, known as the Forty-Mile Bend field, was brought in during the year in Dade County, southeast of the Sunniland field in Collier County.

At the end of the year, plans were being made for deep offshore drill tests, and a wildcat well was reportedly planned for Highlands County.

REVIEW BY COUNTIES

Alachua.—Williston Shell Rock Co. continued to operate its Buda and Haile quarries, and the Newberry Corp. also continued production. The quarry reported in operation by S. M. Wall in 1953 was worked by the Alachua Corp. in 1954.

Total limestone sold or used by producers in 1954 was 376,000 tons valued at $369,000, compared with 266,300 tons valued at $297,500 in 1953. These figures represent a 41-percent increase in tonnage and a 24-percent rise in total value, but an actual 13-percent decrease in unit value.

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TABLE 7.—Crushed limestone sold or used by producers in Alachua County, 1950–54

Year	Short tons	Value	Year	Short tons	Value
1950	(1)	(1)	1953	266,297	$297,518
1951	586,362	$597,995	1954	376,113	368,839
1952	490,332	538,211			

[1] Figure withheld to avoid disclosure of individual company operations.

Bay.—The Brewton Engineering Co. continued to produce building sand but at considerably reduced rate, although the reported total value indicated a substantial increase in unit value. The Cato Sand Co. of Panama City opened a new pit and mined 46,000 tons of building sand valued at $27,000.

Brevard.—The Florida Ore Processing Co. continued to operate its Palm Bay concentrating plant and recovered garnet, ilmenite, rutile, and zircon concentrates from ore obtained in Brevard and Indian River Counties. Production was somewhat below that of 1953.

The C & P Dredging Co. and the ABCO Concrete Co. reported initial production of building sand.

Broward.—Twelve quarries reported production of commercial crushed limestone in 1954 compared with 5 in 1953. Snyder Paving Co., Inc., Meekins, Inc., Deerfield Rock Corp., Hollandale Rock Corp. and Maule Industries, Inc., were the five operators producing both years. In 1954 Hollywood Quarries (Hollywood), E. L. Montgomery, Inc., Road Rock, Inc., L. W. Ruzzo & Son, and R. H. Wright & Sons (all of Fort Lauderdale), F. P. Smith (Dovie), and Zinki & Smith, Inc. (Pompano Beach) reported initial production.

The Broward County Highway Department reported production of noncommercial crushed limestone for concrete aggregate and road metal. Total county output of commercial crushed limestone was 33 percent greater in tonnage and 22 percent greater in total value than in 1953, but average unit value declined 9 cents a ton. Noncommercial production in 1954 was 78,000 tons valued at $50,800 compared with 59,000 tons valued at $30,600 in 1953, an increase of 32 percent in quantity and 66 percent in total value, representing an increase of 13 cents in average unit value.

TABLE 8.—Crushed limestone sold or used by producers in Broward County, 1949–54

Year	Short tons	Value	Year	Short tons	Value
1949	391,340	$299,123	1952	779,255	$786,794
1950	735,394	659,633	1953	1,893,827	2,024,771
1951	979,737	833,936	1954	2,512,541	2,484,438

Meekins, Inc., reported a substantial tonnage of dimension building stone and Deerfield Rock Corp. a small amount of rubble.

Citrus.—Kibler-Camp Phosphate Enterprises reported production of hard rock from its Sec. 17 mine opened in 1953 but did not report production from Sec. 12 mine, which was operated in 1953.

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The five producers reporting soft-rock production in 1953 also reported in 1954 but at somewhat reduced tonnage and value. The continuing producers were Seaboard Phosphate Co. (Sec. 12 mine in 1954 and Manko mine in 1953), Soil Builders, Inc. (Mincoll mine), The Kellogg Co. (Kellogg mine), Knight & Bevis (Seacoll mine in 1953 and Sec. 34 mine in 1954), and Superior Phosphate Co. (Dunnellon mine in 1953 and Bar mine in 1954).

In addition, soft-rock production was reported by Globe Phosphate Co. (Sec. 22 mine), Sun Phosphate Co. (Sec. 10 mine), and Delta Phosphate Co. (Hernando mine).

Connell & Shultz (Citrus Garden quarry) did not report production in 1954, although active in 1953. Golden Dolomite Co. reported a substantial initial production of agricultural limestone from Red Level quarry in 1954.

Clay.—The Humphreys Gold Corp. continued to operate the Trail Ridge Mine (dredge pool) for E. I. du Pont de Nemours & Co., Inc., for the production of a mixed product containing ilmenite, rutile, and leucoxene. Zircon was also recovered as a byproduct.

Collier.—Production of natural gas and petroleum from the Sunniland field continued. Production of natural gas increased 1 million cubic feet, and petroleum production increased 5,000 barrels.

The Sunniland Limerock Co. (Sunniland quarry) reported initial production of commercial crushed limestone for concrete aggregate and road metal.

Columbia.—Loncala Phosphate Rock Co. continued to operate its Fort White mine for the production of soft rock.

Dade.—The city of Miami continued to recover lime as a byproduct in its water-purification operations. Recovery increased slightly over 1953.

The eight operators reporting production of commercial crushed limestone from 10 quarries in 1953 reported continuous operation in 1954. They were Maule Industries, Inc. (Ojus, Red Rock, and Tropical quarries), Murphy & Mills (M & M quarry), Naranja Rock Co. (Naranja quarry), Troup Quarries, Inc. (Troup quarry), Oolite Rock Co. (Oolite quarry), T. J. James Construction Co. (James quarry), Peffer Construction Co. (Peffer quarry), and E. A. Pynchon (Pynchon quarry). In addition, the Seminole Rock Products Co. reported initial production from the Red Road and Medley quarries. Other initial production was Hialeah Crushed Stone Co., Miami (Dade County quarry) and Ideal Crushed Stone Co., Hialeah (Dade County quarry).

The total crushed-limestone production for the county in 1954 was 29 percent greater in tonnage and 74 percent greater in total value than in 1953. This reflects an average increase of 34 cents a ton over 1953.

The Des Rochers Sand Co. and the Florida Silica Sand Co. continued to produce building sand, and the former company also reported some paving and "other" sand.

The Sand Lake Development Co. reported initial production of building sand.

The total value of the mineral production in the county was $7 million, a 33-percent increase over 1953.

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TABLE 9.—Mineral aggregates sold or used by producers, Dade County, 1949–54

Year	Crushed limestone		Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1949	2,383,260	$2,250,435	613,123	$629,328	600,000	$600,000	3,596,383	$3,479,763
1950	2,513,490	2,922,624	859,439	991,765	654,030	954,813	4,026,959	4,869,202
1951	3,347,326	3,914,231	1,342,668	1,454,029	1,295,794	1,646,481	5,985,788	7,014,741
1952	3,579,192	3,793,305	728,502	757,468	973,072	1,347,308	5,280,766	5,898,081
1953	4,038,367	3,805,333	955,468	1,096,059	105,596	143,812	5,099,431	5,045,204
1954	(1)	(1)	(1)	(1)			5,293,017	6,780,036

[1] Figure withheld to avoid disclosure of individual company operations.

Duval.—The Humphreys Gold Corp. operated its concentration plant near Jacksonville in which ores from Rutile Mining Co. and Titanium Division of National Lead Co. were treated to recover ilmenite and rutile. The combined shipments of ilmenite and rutile were below those in 1953, but the total value was greater, indicating increased unit value.

The Humphreys Gold Corp. also recovered zircon as a byproduct in concentrating ilmenite and rutile. Total shipments approximately equaled those of 1953, but the total value was up sharply, reflecting an increasing demand.

Escambia.—The Osceola Clay & Topsoil Co. reported the initial production of 44,000 tons of miscellaneous clay valued at $22,000 for road base, a use fairly common in Florida, but rather unusual elsewhere.

The Campbell Sand & Gravel Co. (formerly Rufus Campbell) and the Ward Gravel Co. continued in operation; both produced sand and gravel. In addition, the E. E. Boone Construction Co. and Coker J. Clark reported initial production of building sand.

The total value of the county mineral production for 1954 just topped $300,000 compared with $262,000 in 1953.

Flagler.—The Bunnell plant of Lehigh Portland Cement Co. continued operation, with production roughly 20 percent above 1953.

Gadsden.—The Floridin Co. continued to operate several mines to supply its Jamieson and Quincy plants, and the Minerals & Chemical Corp. continued to produce fuller's earth. County total production and total value increased somewhat in 1954 over 1953.

Miscellaneous clay for heavy clay products was mined by the Apalachee Correctional Institute, with 1954 production up sevenfold compared with 1953.

The Florida Gravel Co. continued to produce sand and gravel at slightly reduced tonnage but at an appreciable increase in total value.

Gilchrist.—The Loncala Phosphate Co. continued to produce soft phosphate rock from its Mona mine but at considerable curtailed rate compared with 1953.

Hernando.—Production of commercial crushed limestone continued during 1954 by the same operators as in 1953, namely, the Camp Concrete Rock Co., Wm. P. McDonald Corp., and the Brookville Rock Co. Total county production was 2.1 million tons valued at $3.2 million, an appreciable increase over 1953.

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Highlands.—The Highlands County Highway Department reported the production and use of 21,600 tons of paving sand valued at $10,800.

Hillsborough.—Jose N. Suarez reported initial production of sand for unspecified uses.

The General Portland Cement Co. continued to operate its Tampa mill and quarried limestone for cement manufacture. Cement shipments increased 4 percent and total value 5 percent above 1953.

The American Agricultural Chemical Co. and the American Cyanamid Co. continued to produce land-pebble phosphate rock. Although combined production was slightly below 1953, the total value was greater, reflecting an increased average unit value.

Indian River.—The Florida Ore Processing Co. continued to produce ilmenite and rutile sands for shipment to its Palm Bay concentrating plant in Brevard County.

B. M. Walker reported a small initial production of building sand.

Jackson.—The Marjax Co. cut production from its Marjax quarry roughly 50 percent below 1953.

Lafayette.—The Williston Shell Rock Co. reduced production of its Mayo quarry for the second consecutive year, with 1954 production roughly 37 percent below that of 1953.

The Suwannee River Sand Co. reported a substantial initial production of paving sand.

Lake.—The Central Sand Co. increased its output of building sand above 1953 but at a slightly reduced unit value.

Leon.—Leon County was the scene of new sand production by 3 producers, with a total value of $33,000. The producers were Asa Maige Sand Co. (Norfleet pit), Middle Florida Sand Co. (Tallahassee pit), and Johnson Sand Co. (Johnson pit) all of Tallahassee.

Levy.—Connell & Shultz continued operation of the Williston quarry for road base, and Dixie Lime Products Co. continued production from the Lebanon quarry for agricultural limestone. The Raleigh quarry, formerly operated by V. E. Whitehurst & Sons, was taken over in 1954 by the W. & M. Construction Co. for the production of concrete, road metal, and agricultural limestone. No production was reported by the Levy County Lime Rock Corp. and the United Limerock Corp. in 1954, although both were active in 1953. Total county production was somewhat below 1953.

TABLE 10.—Crushed limestone sold or used by producers in Levy County, 1949–54

Year	Short tons	Value	Year	Short tons	Value
1949	165,330	$299,133	1952	400,543	$684,073
1950	(1)	(1)	1953	320,415	651,311
1951	387,353	539,772	1954	(1)	(1)

[1] Figure withheld to avoid disclosure of individual company operations.

Manatee.—The Manatee Dolomite Co. (Manatee quarry) and the Southern Dolomite Co. (Southern quarry) continued to produce commercial crushed limestone. Production in 1954 roughly doubled that in 1953.

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The Alclaries Travertine Co. quarried 273 tons of dimension building stone valued at $1,500, 825 tons of rubble valued at $1,640, and 25 tons of riprap valued at $100—an appreciable total increase over 1953.

F. A. Edwards continued to mine building sand from his Bradenton pit but at slightly reduced rate compared with 1953. E. E. Rainey reported initial production of paving gravel from his Cedar Hammock pit. Total county production of sand and gravel was somewhat greater than 1953.

Marion.—Production of lime for building, agricultural, and chemical purposes by the Dixie Lime Products Co. was slightly above 1953 but declined in total value.

The Cummer Lime & Mfg. Co. continued operation of its Kendrick (Cummer) quarry for concrete aggregate, road metal, and agricultural limestone and opened a new quarry (Martin) for concrete aggregate, road metal, railway ballast, agricultural limestone, and other markets. The Ocala Lime Rock Corp. continued to operate its Kendrick quarry for concrete aggregate and road metal. The Dixie Lime Products Co. operated its No. 3 and Reddick quarries for concrete aggregate, road metal, and agricultural limestone, in addition to stone for its limekilns. The W. L. Cobb Construction Co. reported initial production of crushed limestone for concrete aggregate and road metal from the York quarry. Total commercial crushed limestone from the county more than doubled 1953 production, but unit value dropped appreciably.

Pedrick & Bernard continued to operate its Morriston mine for soft-rock phosphate and increased production roughly 50 percent above 1953.

TABLE 11.—Crushed limestone sold or used by producers in Marion County, 1949–54 [1]

Year	Short tons	Value	Year	Short tons	Value
1949	245,642	$315,165	1952	748,760	$1,010,099
1950	453,300	546,952	1953	530,843	722,369
1951	1,033,506	1,207,439	1954	1,171,124	1,187,158

[1] Exclusive of limestone used in manufacturing lime.

Total value of Marion County mineral production in 1954 was $1.4 million.

Monroe.—Charley Toppino & Son (Stock Island quarry) quarried crushed limestone for concrete aggregate and road metal. This company also reported considerable production of building gravel. Alonzo Cothron (Matecumbe Key quarry), who operated in 1952 and 1953, did not report production in 1954.

Dimension-limestone production was not reported in 1954, although there was a small output in 1953 and 1952.

Okaloosa.—Okaloosa County entered the list of mineral producers in 1954 with a small production of building sand by Perry's Sand Co. (Perry pit).

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Orange.—Production of peat in Orange County was reported as 12,000 tons valued at $43,000.

Palm Beach.—Hoyt Sand & Muck Co. (Hoyt pit) produced a small tonnage of sand for various uses.

Palm Beach County Highway Department reported production of 49,000 tons of noncommercial crushed limestone valued at $29,000 for concrete aggregate and road metal.

There were four active producers of commercial crushed limestone in 1954—Belle Glade Rock Co. (Belle Glade quarry), Burnup & Sims (Peanut Island quarry), Handley Construction Co. (Palm Beach County quarry), and Driskell & Mays (Dubois quarry). Total county mineral production was valued at $242,000.

Pinellas.—Production of sand for building, paving, and other uses by the Largo Washed Sand Co. (Largo pit) was 68,000 tons valued at $85,500 in 1954, compared with 69,000 tons valued at $81,500, reflecting an increase in unit value.

Charles E. Phillips (Pinellas County quarry) reported initial production of crushed limestone for concrete aggregate and road metal.

Polk.—Land-pebble-phosphate-rock production in 1954 increased 14 percent in tonnage and 15 percent in value above 1953, reflecting a small increase in average unit value. Production came from the same 7 companies and 12 mines as in 1953—the American Agricultural Chemical Corp. (South Pierce mine and Pierce mill); American Cyanamid Co. (Saddle Creek mine and Brewster mill); Coronet Phosphate Division, Smith-Douglass Co. (Tenoroc mine and mill); Davison Chemical Division of W. R. Grace & Co. (Pauway and Bonny Lake mines and Ridgewood mill); International Minerals & Chemical Corp. (Achan, Noralyn, and Peace Valley mines and Noralyn-Mulberry mill); Swift & Co. (Varn and Watson mines and Agricola mill); and Virginia-Carolina Chemical Corp. (Clear Springs and Homine mines and Phosmico and Nicholls mills).

Two new producers of building sand were recorded in 1954, namely, Mammoth Sand Co. (Lake Wales pit) and MacCalla Bros. Inc. (Polk County pit). Four other producers continued to produce building and paving sand—Lake Wales Concrete Sand Co. (Lake Wales pit); Lake Wales Independent Sand Co. (Independent pit); Standard Sand & Silica Co. (Standard pit); and Oak Ridge Sand Co. (Achan pit). The Davenport Sand Co., Inc., continued production but reported building sand only. The Standard Sand & Silica Co. reported preparation of some blast sand and also sand for other unidentified uses. The Mammoth Sand Co. reported production of paving and engine sand.

TABLE 12.—Sand sold or used by producers in Polk County, 1951–54

Year	Short tons	Value	Year	Short tons	Value
1951	698,101	$451,527	1953	1,185,952	$843,124
1952	1,010,744	703,744	1954	1,706,132	1,150,408

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Putnam.—As in 1953, Edgar Plastic Kaolin Co. and United Clay Mines Corp. supplied the kaolin production, which was virtually the same as in 1953.

Sand production also came from the same producers as in 1953, namely: The Diamond Interlachen Co. Inc. (Diamond pit); Keuka Sand Co. (Putnam County pit); United Clay Mines Corp. (Crossley pit); All-Florida Sand Co. (Interlachen pit); and Keystone Sand Co. (Grandin pit).

TABLE 13.—Sand sold or used by producers in Putnam County, 1949–54

Year	Short tons	Value	Year	Short tons	Value
1949	261,110	$183,909	1952	595,473	$362,323
1950	389,705	234,788	1953	654,534	407,070
1951	422,268	249,362	1954	528,369	335,636

St. Johns.—St. Johns County entered the list of mineral-producing counties with an initial production of crushed limestone reported by Phillip McLeod (riprap); Claussen-Lawrence Construction Co. (concrete aggregate and road metal); and E. B. Meade & Sons Building Contractors (concrete aggregate).

Sarasota.—The Florida Dolomite Co. (Sarasota quarry) quarried and crushed limestone for agricultural markets.

Sumter.—The Central Quarries, Inc., opened the Sumterville quarry and quarried 104,000 tons of crushed limestone for concrete aggregate and road metal.

Suwannee.—The Suwannee Limerock Co. (Ralph quarry) reported production of 132,000 tons of crushed limestone for concrete and road metal and 7,000 tons for agricultural markets. Total tonnage nearly doubled that of 1953.

Volusia.—Production of building sand was continued by Hauser Construction Co. The White Sand & Material Co. (White pit) reported initial production of building sand, and H. C. Barbour Co. reported initial production of an appreciable tonnage of sand for unspecified markets.

Walton.—The Walton Brick & Tile Co. (De Funiak Springs mine) mined clay for its own use in manufacturing heavy clay products.

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The Mineral Industry of Georgia

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Geological Survey of Georgia.

By James L. Vallely [1] and Garland Peyton [2]

THE VALUE of mineral production in Georgia in 1954 was $55.8 million, a 9-percent increase above the total ($51.4 million) recorded in 1953. Nonmetallic minerals constituted almost 98 percent of Georgia's mineral production, with metals, coal, and peat composing the remainder. Tonnages and values of most minerals increased over 1953. Exceptions were bauxite, which increased in tonnage but decreased slightly in value, and iron ore, lime, and talc, which declined in both tonnage and value. Some of the production data for 1954 were collected jointly with the Bureau of the Census (U. S. Department of Commerce). Production totals will be compared

TABLE 1.—Mineral production in Georgia, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	2,651,153	$23,455,315	2,711,422	$24,106,926
Coal	14,100	70,500	8,090	40,450
Gold (recoverable content of ores, etc.)—troy ounces	2	70		
Iron ore (usable)—long tons, gross weight	259,964	1,100,725	221,576	871,901
Lime (open-market)	9,345	95,484	(2)	(2)
Mica (sheet)—pounds	[3] 14,063	[3] 73,806	(4)	254,093
Iron oxide pigment materials			(2)	(2)
Peat	2,305	(2)	5,150	60,920
Sand and gravel	2,051,058	1,900,987	2,703,281	2,466,352
Sand and sandstone (ground)	(2)	(2)	(5)	(5)
Stone	[6] 7,112,024	[6] 17,756,302	8,057,600	21,384,227
Talc and soapstone (crude)	57,891	202,619	50,536	176,876
Undistributed: Asbestos, barite, bauxite, beryllium concentrates, cement, feldspar (1954), manganese ore (1954), mica, scrap and flake (1953), slate, and minerals whose value must be concealed for a particular year (indicated in appropriate column by footnote reference 2). Excludes value of clays used for cement (1953)		6,739,022		7,202,366
Total Georgia		51,395,000		[7] 55,803,000

[1] Production as measured by mine shipments, mine sales, or marketable production (including consumption by producers).
[2] Included with "Undistributed."
[3] Excludes scrap and flake mica in 1953.
[4] Figure withheld to avoid disclosure of individual company operations.
[5] Included with sand and gravel.
[6] Excludes stone used in cement and lime.
[7] The total has been adjusted to eliminate duplication in the values of clays and stone.

[1] Mining engineer, Region V, Bureau of Mines, Knoxville, Tenn.
[2] State geologist, Georgia Geological Survey, Atlanta, Ga.

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with the census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

Clays, stone, cement, sand and gravel, iron ore, bauxite, and slate, in that order, retained their rank as the principal mineral products of the State in 1954.

Mineral production was reported from 70 of Georgia's 159 counties; 14 of these produced minerals valued at $47 million or 85 percent of the total. Rated on value of output, Twiggs, Pickens, Washington, De Kalb, Wilkinson, Houston, Polk, Bartow, Decatur, Gilmer, Elbert, Richmond, Henry, and Warren Counties, in the order given, were the most important mineral-producing counties in the State; each had an output valued above $1 million.

The Defense Minerals Exploration Administration (DMEA), under its program to aid the exploration and development of strategic minerals, participated in 8 exploration contracts in 1954—1 for

TABLE 2.—Average unit values of mineral commodities produced in Georgia, 1950–54 [1]

Commodity	1950	1951	1952	1953	1954
Asbestos, short ton	$100.00	$100.00	$100.00	$100.00	$100.00
Barite, do	10.70	11.34	11.75	12.82	13.91
Bauxite, long ton	(2)	(2)	(2)	(2)	(2)
Beryl, short ton			596.00		654.75
Cement, 376-pound barrel	2.35	2.53	2.54	2.65	2.71
Clays:					
Fuller's earth, short ton	17.57	18.00	18.11	18.73	19.98
Kaolin (china, paper, etc.), do	15.21	15.35	[3] 15.40	15.89	16.49
Kaolin (refractory), do	6.05	6.16	[3] 6.37	6.60	7.39
Miscellaneous, do	.79	.90	.97	.93	.80
Coal, do	5.57	4.00	5.00	5.00	5.00
Feldspar, long ton	4.79	4.94			8.22
Gold, troy ounces		35.00		35.00	
Gravel, short ton	3.08		[3] 1.53	1.57	1.63
Iron ore, long ton	3.35	3.75	4.50	4.23	3.93
Lime, short ton	10.13	9.86	11.15	10.22	9.92
Manganese, long ton					(2)
Mica:					
Sheet, pound	.21	.26	1.45	5.25	(2)
Scrap and flake, short ton	21.84	23.47	25.88	24.01	(2)
Mineral pigments (ocher, crude), do	(4)	(4)	(4)	(4)	3.91
Peat, do	23.50	18.25	17.70	17.38	11.83
Sand:					
Ground, do	10.00	10.00	10.00	10.00	(5)
Structural and paving, do	.56	.57	.69	.65	.69
All other, do	1.47	1.60	1.48	1.70	1.20
Slate (flour and granules), do	6.92	7.23	7.41	7.41	6.93
Stone:					
Granite:					
Crushed, do	1.28	1.46	1.55	1.56	1.59
Dimension, do	[3] 19.33	[3] 20.68	[3] 18.60	19.04	19.03
Limestone:					
Crushed, do	2.69	3.15	2.87	2.48	2.06
Dimension, do			3.76	2.58	2.79
Marble:					
Crushed, do	5.01	7.69		8.35	8.43
Dimension, do	119.74	140.75	130.67	136.65	123.63
Miscellaneous:					
Crushed, do	.97	1.50	.25		
Dimension, do	4.00		10.78		
Quartzite, do			1.66	1.56	1.42
Talc:					
Crude, do	(4)	(4)	(4)	3.50	3.50
Ground, do	9.65	9.22	10.24	10.33	10.05

[1] For greater detail on prices by grades and markets, see vol. I, Minerals Yearbook, 1954.
[2] Figure withheld to avoid disclosure of individual company operations.
[3] Revised figure.
[4] Data not available.
[5] Included with "Sand (all other)."

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beryl-mica in Cherokee County and 7 for mica in Lamar, Monroe (2), Pickens, Union, and Upson (2) Counties. Three projects were new in 1954, and five begun during the previous year continued into 1954. DMEA provided 87 percent of the total spent ($9,182) in 1954. In 1953 the Government share of $19,439 spent on the same number of projects was 88 percent.

TABLE 3.—DMEA projects in Georgia, 1954

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation (percent)
Cherokee: Stancel & Jones	Brady (Cochran) mine	Beryl and mica.	Nov. 16, 1953	$4,475	90
Lamar: Empire Mica Co.	Harrison W. Harp mine	Mica	June 29, 1953	7,400	90
Monroe:					
Thomas Johnson (Howell & Anderson).	Thaddeus Persons mine	do	Apr. 30, 1953	9,000	90
Homer C. Mundy et al.	Dickens mine	do	Sept. 24, 1953	3,100	90
Pickens: Alex Teague	Old Denson mine	do	July 12, 1954	2,994	75
Union: Tralyta Mining Co.	Lake Tralyta property	do	Nov. 1, 1954	5,716	75
Upson:					
C. R. Phillips et al.	J. H. Reynolds mine	do	Nov. 3, 1953	6,650	90
Empire Mica Co.	Short-Mitchell mine	do	July 2, 1953	8,600	90

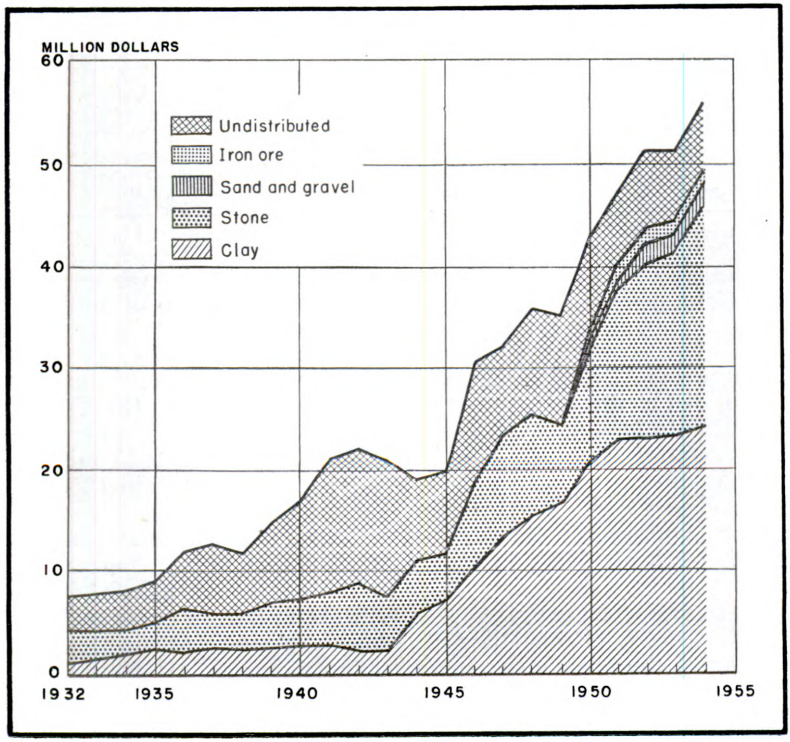

FIGURE 1.—Total value of mineral production in Georgia, 1932–54.

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REVIEW BY MINERAL COMMODITIES

METALS

Bauxite.—American Cyanamid Co. was the only producer in the State in 1954; crude bauxite from its mines in Bartow and Macon Counties was dried at the Halls Station plant in Bartow County for shipment to the chemical industry.

Beryllium.—Production of beryl in 1954 greatly exceeded that in the previous year. Production came principally from the Hogg mine in Troup County; this mine was developed through exploration under the DMEA program. One DMEA contract for beryl-mica in Cherokee County was active in 1954.

Iron Ore.—Brown-iron-ore shipments declined for the third consecutive year from a high of 358,000 tons in 1951. Production and shipments in 1954 were 221,600 tons valued at $872,000, decreases of 15-percent in tonnage and 21 percent in value from 1953. Except for small tonnages of brown ore shipped from Quitman County in the southwestern part of the State and red ore from Walker County, all production came from the Cartersville district, Bartow County, and the Cedartown district, Polk County, both in the northwestern part of the State.

TABLE 4.—Production and shipments of usable brown iron ore, 1945–49 (average) and 1950–54 [1]

Year	Production	Shipments		Year	Production	Shipments	
	Long tons	Long tons	Value		Long tons	Long tons	Value
1945–49 (average)	271,816	271,816	$672,644	1952	369,259	319,959	$1,439,251
1950	202,427	202,427	677,248	1953	210,664	259,964	1,100,725
1951	357,754	357,754	1,339,248	1954	221,576	221,576	871,901

[1] Includes hematite: 1950—213 tons; 1951—266 tons; 1952—200 tons; 1953—250 tons; 1954—217 tons.

Manganese Ore.—A small tonnage of manganese ore was mined in Bartow County—the first production recorded in the State since 1945.

NONMETALS

Asbestos.—Small tonnages of amphibole asbestos continue to be produced in Georgia. Production in 1954 came from the Cornelia mine in Rabun County.

Barite.—Crude barite sold or used by producers in 1954 increased only 1 percent, but its value was 10 percent higher than in 1953. All barite produced came from Bartow County.

Cement (Portland).—Production of portland cement in 1954 showed little change from 1953, but sales increased almost 7 percent and value 9 percent. Effective January 1, 1954, Marquette Cement Manufacturing Co. purchased the Southern States Portland Cement Co. at Rockmart. Penn-Dixie Cement Corp. at Clinchfield operates the second of the State's two cement plants.

Clays.—Clays rank first in value among the minerals produced in the State and in 1954 represented 43 percent of the value of all mineral production. Clays sold or used by producers totaled 2.7 million tons

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valued at $24 million, increases of 2 and 3 percent, respectively, in quantity and value over 1953. Kaolin production decreased slightly less than 2 percent in tonnage but increased more than 4 percent in value. Fuller's earth declined for the third consecutive year from its peak in 1951, tonnage dropping 9 percent and value 5 percent. Although miscellaneous clay showed an increase of 9 percent in tonnage, it declined 6 percent in value.

Clays were produced in 16 counties in 1954, including fuller's earth in Decatur, Grady, and Twiggs Counties; and kaolin in Baldwin, Glascock, Richmond, Twiggs, Washington, and Wilkinson Counties. Other clays were mined in Bibb, Crawford, Floyd, Fulton, Gordon, Houston, Polk, Richmond, Thomas, and Whitfield Counties.

TABLE 5.—Clays sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	1,903,223	$13,904,127	1952	2,562,182	$23,137,507
1950	2,408,890	21,028,266	1953	2,651,153	23,455,315
1951	2,603,338	23,199,758	1954	2,711,422	24,106,926

TABLE 6.—Kaolin sold or used by producers, 1945–49 (average) and 1950–54, by uses

Year	China clay, paper clay, etc.		Refractory uses		Total kaolin	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	845,357	$10,902,265	112,839	$609,865	958,196	$11,512,130
1950	1,087,174	16,533,582	133,481	806,946	1,220,655	17,340,528
1951	1,147,865	17,615,634	175,945	1,084,101	1,323,810	18,699,735
1952	1,145,063	17,635,838	183,192	1,166,355	1,328,255	18,802,193
1953	1,170,679	18,606,351	171,046	1,053,274	1,341,725	19,659,625
1954	1,196,211	19,722,623	108,654	803,283	1,304,865	20,525,906

TABLE 7.—Miscellaneous clay sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	835,016	$647,672	1952	1,050,792	$1,020,132
1950	1,024,095	804,190	1953	1,163,766	1,076,891
1951	1,083,952	978,727	1954	1,278,377	1,020,486

Feldspar.—Feldspar production was resumed late in 1954, after a lapse since 1951, when the new flotation mill of Appalachian Minerals Co. at Monticello, Jasper County, was placed in operation.

Lime.—Production of lime was considerably lower than in 1953 and production ceased altogether early in 1954 with closing of the plant of Ladd Lime & Stone Co. near Cartersville, the only producer in the State.

Mica.—Sheet-mica and scrap- and flake-mica production showed considerable gains in 1954. The total mica production was valued at $254,000. Monroe County was the leading producer of sheet mica, in terms of value, followed by Pickens and Hart. Other counties producing smaller amounts were Elbert, Franklin, Hall,

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Lamar, Oconee, Pike, and Spalding. Scrap and flake mica came principally from Cherokee, Hart, and Pickens Counties, with small tonnages reported from Elbert, Greene, and Upson Counties. DMEA aided in exploring 8 properties in 6 counties in 1954. Including 1 mica-beryl project in Cherokee County, $9,182 was spent during the year, of which the Government share was 87 percent. The total amount of DMEA contracts involved was $47,935; Government participation was 87 percent.

Mineral Pigments.—Crude and finished iron oxide pigments (yellow ocher) were produced by the New Riverside Ochre Co. at Cartersville, Bartow County.

Sand and Gravel.—Sand and gravel is the third most important of the minerals produced in Georgia in terms of value and tonnage. Production in 1954 was 2.7 million tons valued at $2.5 million, increases of 32 and 30 percent, respectively, in tonnage and value above 1953. Crushed sand, reported separately in previous years, is included with sand and gravel production in 1954. Thirty-one operators reported production from 21 counties. The principal producing counties were Bibb, Crawford, Dougherty, Effingham, Muscogee, Talbot, Taylor, and Thomas.

TABLE 8.—Sand and gravel sold and used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	879,175	$585,187	1952	2,133,970	$2,029,367
1950	[1] 1,211,782	[1] 936,726	1953	2,051,058	1,900,987
1951	1,226,231	1,041,561	1954	[2] 2,703,281	[2] 2,466,352

[1] Commercial only. Excludes Government-and-contractor production.
[2] Includes ground sand, formerly reported separately.

Slate.—Slate production was substantially increased in 1954 by the addition of tonnage mined by the Georgia Lightweight Aggregate Co., the slate being used as raw material in an expanded lightweight-aggregate plant at Rockmart. Funkhouser Co., producing slate flour and granules, was the only other producer in the State.

Stone.—Stone was the second most important of Georgia minerals with respect to value of production and represented 38 percent of the State total in 1954. Production of stone in 1954 was 8.1 million tons, valued at $21.4 million.

Dimension-stone production increased 45 percent in tonnage and 41 percent in value, with granite showing gains of 40 percent in both quantity and value and marble 55 percent in tonnage and 40 percent in value. Only minor quantities of dimension limestone and sandstone were reported in 1954.

Granite and quartzite accounted for 74 percent of the total stone tonnage and 60 percent of the value; limestone 22 and 17 percent, respectively, of total tonnage and value; and marble and sandstone the remaining 4 percent of tonnage and 23 percent of value. Crushed stone represented 97 percent of the tonnage and 69 percent of the value of all stone produced in 1954. Granite was produced in 14 counties; quartzite in Richmond County only; limestone in 9 counties; and marble in Pickens County only.

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TABLE 9.—Sand and gravel sold or used by producers, by classes of operations and uses, 1952–54

	1952		1953		1954	
	Short tons	Value	Short tons	Value	Short tons	Value
Sand—commercial:						
Glass	[1]	[1]	[1]	[1]	[2]	[2]
Molding	[1]	[1]	[1]	[1]	[2]	[2]
Building	994,498	$717,529	1,037,669	$667,371	1,233,216	$827,925
Paving	449,712	278,130	438,629	285,469	583,030	423,591
Grinding and polishing	94,010	195,242	59,084	180,047	[2]	[2]
Engine	29,018	13,202	27,077	13,911	[2]	[2]
Filter	[1]	[1]	[1]	[1]		
Railroad ballast	31,061	15,637	27,008	14,854	[2]	[2]
Other	209,843	238,709	156,893	174,718	[3] 110,184	[3] 152,834
Undistributed					420,415	481,442
Commercial total	1,808,142	1,461,449	1,746,360	1,336,370	2,346,845	1,885,792
Government-and-contractor			1,350	750		
Total sand	1,808,142	1,461,449	1,747,710	1,337,120	2,346,845	1,885,792
Gravel—commercial:						
Building	59,880	101,190	[1]	[1]	[4]	[4]
Paving	[1]	[1]	[1]	[1]	[4]	[4]
Other	37,126	35,910			[4]	[4]
Commercial total	97,006	137,100	[1]	[1]	351,686	577,160
Government-and-contractor	33,792	45,938	3,375	500	4,750	3,400
Total gravel	130,798	183,038	3,375	500	356,436	580,560
Sand and gravel:						
Commercial total	1,905,148	598,549	1,746,360	1,336,370	2,698,531	2,462,952
Government-and-contractor	33,792	45,938	4,725	1,250	4,750	3,400
Undistributed	195,030	384,880	299,973	563,367		
Grand total	2,133,970	2,029,367	2,051,058	1,900.987	2,703,281	2,466,352

[1] Included with Sand and Gravel—"Undistributed."
[2] Included with Sand—"Undistributed."
[3] Includes ground sand.
[4] Figure withheld to avoid disclosure of indivuidual company operations.

TABLE 10.—Stone sold or used by producers, 1952–54, in short tons

	1952		1953		1954	
	Short tons	Value	Short tons	Value	Short tons	Value
Crushed stone:						
Granite	5,746,901	$8,880,139	5,866,434	$9,177,989	5,078,952	$8,080,493
Limestone	1,218,515	3,498,420	899,105	2,230,111	[1] 1,806,899	[1] 3,722,108
Marble			188,900	1,578,008	218,678	1,843,530
Sandstone and quartzite					725,000	1,030,000
Miscellaneous	14,751	3,680				
Total crushed stone	6,980,167	12,382,239	6,954,439	12,986,108	[1] 7,829,529	[1] 14,676,131
Dimension stone:						
Granite	129,517	2,408,654	137,817	2,624,233	193,270	3,678,193
Limestone	[2]	[2]	4,142	10,684	3,065	8,545
Marble	17,953	2,345,979	15,626	2,135,277	24,251	2,998,031
Miscellaneous	4,445	29,236				
Sandstone					7,485	23,327
Total dimension stone	151,915	4,783,869	157,585	4,770,194	228,071	6,708,096
Grand total	7,132,082	17,166,108	7,112,024	17,756,302	[1] 8,057,600	[1] 21,384,227

[1] Includes stone used in cement and lime.
[2] Included with "Dimension, miscellaneous."

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Talc.—Production of crude talc and soapstone was 50,500 tons valued at $177,000 in 1954, a decrease of 13 percent in quantity and value from the previous year. Sales of ground talc in 1954 were 50,200 tons valued at $505,000 against 57,600 tons with a value of $594,900 in 1953, a decline of 13 percent in quantity and 15 percent in value. Sales of sawed material were also lower in 1954.

MINERAL FUELS

Coal.—Coal production reported from Georgia in 1954 amounted to 8,090 tons valued at $40,450; production in 1953 was 14,100 tons.

Peat.—Peat was produced in three Georgia counties in 1954—Lowndes, Pike, and Screven—and totaled 5,200 tons valued at $61,000, an increase of 123 percent above the 2,300 tons produced in 1953.

TABLE 11.—Production of peat, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	2,488	$49,431	1952	2,150	$38,000
1950	1,750	41,000	1953	2,305	(1)
1951	2,250	41,000	1954	5,150	60,920

[1] Figure withheld to avoid disclosure of individual company operations.

REVIEW BY COUNTIES

Atkinson.—Bannockburn Sand Co. of Valdosta was the only mineral producer in the county in 1954.

Baldwin.—General Refractories Co. produced kaolin for refractory use from the Woods mine at Stevens Pottery.

Bartow.—Mineral production in Bartow County in 1954 was valued at $2.5 million compared with $2.6 million in 1953, a decrease of 2 percent. The value of all minerals produced in the county, except barite and iron ore, declined from the previous year. In order of value, barite, iron ore, slate, and limestone were the most important minerals produced in the county in 1954. Other minerals were bauxite, manganese ore, and iron oxide pigments (ocher). Barite was mined near Cartersville by B. R. Cain Mining Co., J. W. Cox, New Riverside Ochre Co., and Paga Mining Co. American Cyanamid Co. mined bauxite from the Fountain and Julia mines and operated its drying plant at Halls Station. Brown-ore production and shipments in 1954 were 148,600 tons valued at $565,000, increases of 31 percent in tonnage and 26 percent in value over 1953. Producers in 1954 were: Bartow mines, Hodge Mining Co., Lake Mining Co., Lamb & Shropshire, and Mosteller Bros., all of Cartersville. Lime production for 1954 dropped sharply when the quarry and plant of Ladd Lime & Stone Co. west of Cartersville, the only lime producer in the State, was closed down. Stockbridge Stone Co. continued to operate its limestone quarry at White in the northern part of the county. Hale-Georgia Minerals Corp. shipped some manganese ore during the year, the first reported in the State since 1945. New Riverside Ochre Co. mined and processed iron oxide pigment materials (ocher), and a large tonnage of

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TABLE 12.—Value of mineral production in Georgia, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value
Atkinson	(2)	(2)	Sand.
Baldwin	(2)	(2)	Kaolin.
Bartow	[3] $2,494,448	$2,438,917	Barite, iron ore, slate, limestone.
Bibb	683,459	713,140	Clays, granite, sand and gravel.
Chatham	(2)	(2)	Sand.
Cherokee	(2)	(2)	Mica.
Clayton	16,200		
Cobb	399,238	493,031	Granite.
Colquitt	(2)		
Columbia	(2)	(2)	Clays.
Crawford	252,898	(2)	Sand.
Dade	33,000	(2)	Limestone.
Dawson		(2)	Sand.
Decatur	(2)	(2)	Fuller's earth.
De Kalb	3,199,583	3,981,078	Granite.
Dougherty	(2)	118,767	Sand.
Effingham	(2)	(2)	Do.
Elbert	1,279,720	1,629,198	Granite, mica.
Evans		(2)	Sand.
Fannin	20,368		
Fayette	(2)	(2)	Granite.
Floyd	(2)	353,700	Limestone, clays.
Franklin	(2)	(2)	Mica.
Fulton	392,171	136,342	Clays, sand and gravel.
Gilmer	1,327,494	(2)	Limestone.
Glascock	(2)	(2)	Kaolin.
Glynn		(2)	Sand.
Gordon	26,880	(2)	Clays.
Grady	(2)	(2)	Fuller's earth.
Greene		(2)	Feldspar, mica.
Gwinnett	122,542	134,083	Granite.
Hall		(2)	Mica.
Hancock	369,321	266,586	Granite.
Hart	(2)	(2)	Mica.
Henry	1,216,984	(2)	Granite.
Houston	(2)	(2)	Cement, limestone.
Jasper		(2)	Feldspar.
Jones		23,000	Granite.
Lamar		(2)	Mica.
Long	(2)	(2)	Sand.
Lowndes	(2)	(2)	Peat.
Macon	(2)	(2)	Bauxite.
Madison	(2)	345,900	Granite.
Mitchell		17,544	Limestone.
Monroe	(2)	21,640	Mica.
Montgomery		(2)	Sand.
Murray	202,619	176,876	Talc and soapstone.
Muscogee	513,977	932,737	Sand and gravel, granite.
Oconee	1,905	(2)	Mica.
Oglethorpe	533,385	766,392	Granite.
Pickens	3,747,374	4,883,639	Marble, mica.
Pike		(2)	Mica, peat.
Polk	(2)	(2)	Cement, iron ore, slate.
Quitman		(2)	Iron ore.
Rabun	(2)	(2)	Asbestos.
Richmond	2,438,403	1,589,080	Clays, quartzite, sand.
Screven		(2)	Peat.
Spalding		(2)	Mica.
Stephens	(2)	78,831	Granite.
Talbot	(2)	(2)	Sand.
Taylor	(2)	(2)	Do.
Telfair		(2)	Do.
Thomas	(2)	(2)	Sand, and clay.
Troup		(2)	Beryllium
Turner	(2)		
Twiggs	(2)	12,543,077	Kaolin.
Upson	37,938	77,495	Mica.
Walker	47,434	(2)	Limestone, coal.
Ware		(2)	Sand.
Warren	(2)	(2)	Granite.
Washington	[3] 4,768,916	4,162,386	Kaolin.
Whitfield	152,250	(2)	Clay, limestone.
Wilkinson	[3] 7,467,181	3,692,143	Kaolin.
Undistributed	19,649,142	16,227,376	
Total	51,395,000	55,803,000	

[1] The following counties are not listed, since no production has been reported: Appling, Bacon, Baker, Banks, Barrow, Ben Hill, Berrien, Bleckley, Brantley, Brooks, Bryan, Bulloch, Burke, Butts, Calhoun, Camden, Candler, Carrol, Catoosa, Charlton, Chattahoochee, Chattooga, Clarke, Clay, Clinch, Coffee, Cook, Coweta, Crisp, Dodge, Dooly, Douglas, Early, Echols, Emanuel, Forsyth, Habersham, Haralson, Harris, Heard, Irwin, Jackson, Jeff Davis, Jefferson, Jenkins, Johnson, Lanier, Laurens, Lee, Liberty, Lincoln, Lumpkin, McDuffie, McIntosh, Marion, Meriwether, Miller, Morgan, Newton, Paulding, Peach, Pierce, Pulaski, Putnam, Randolph, Rockdale, Schley, Seminole, Stewart, Sumter, Taliaferro, Tattnall, Terrell, Tift, Toombe, Towns, Treutlen, Union, Walton, Wayne, Webster, Wheeler, White, Wilcox, Wilkes, Worth.

[2] Included with "Undistributed."

[3] Production of 1 operator prorated between Washington and Wilkinson Counties.

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barite. Funkhouser Co. operated its mine and plant near Fairmont, producing slate granules and flour for use in manufacturing roofing materials.

TABLE 13.—Total mineral production, Bartow County, 1950–54

Year	Value	Year	Value
1950	$1,763,606	1953	$2,494,448
1951	2,236,276	1954	2,438,917
1952	2,834,676		

TABLE 14.—Lime sold and used by producers in Bartow County, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	5,973	$60,487	1952	7,854	$87,587
1950	11,998	121,556	1953	9,345	95,484
1951	10,616	104,626	1954	(1)	(1)

[1] Figure withheld to avoid disclosure of individual company operations.

TABLE 15.—Shipments of brown iron ore in Bartow County, 1950–54

Year	Long tons	Value	Year	Long tons	Value
1950	32,377	$116,722	1953	113,024	$447,169
1951	161,883	611,981	1954	148,601	564,778
1952	146,332	585,476			

Bibb.—Mineral production in 1954 was valued at $713,000, an increase of 4 percent above the previous year; 1954 production, however, excludes kaolin, which, although processed in Bibb County, was mined in Twiggs, not Bibb, as reported in 1953. Sand and gravel production was 155,000 tons valued at $175,000 compared with 128,000 tons with a value of $75,000 in 1953, an increase of 133 percent in value. Producers were Cornell-Young Co., Macon Brick & Block Co., Mathis Akins Concrete Block Co., and W. G. Scott Sand & Gravel Co. Burns Brick Co, and Cherokee Brick & Tile Co. mined clay for use in their clay-products plants at Macon. Hitchcock Corp. and Macon Stone Co. produced crushed granite at quarries near Macon.

Chatham.—J. W. Fitzgerald Co., Inc., dredging sand near Savannah, was the only mineral producer in the county.

Cherokee. Thompson, Weinman & Co. mined sericite from the Brady mine and shipped it to its Cartersville plant for further processing. Stancel & Jones prospected the Brady (Cochran) mine for beryl and mica under the DMEA program for assistance in the exploration and development of strategic minerals. The total amount of the contract was $4,475 with Government participation of 90 percent.

Cobb.—Crushed granite was produced by the Kennesaw Stone Co., the Stockbridge Stone Co., and the Cobb County Road Commission. Alonzo Field reported production of a small tonnage of sand.

Columbia.—Georgia Vitrified Brick & Clay Co. mined clay from the Campania mine for use in its clay products plant at Harlem.

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Crawford.—Atlanta Sand & Supply Co. operated the Rollo sand pit south of Roberta, and the Middle Georgia Pottery Co. mined clay for use in its plant at Lizella.

Dade.—Dave L. Brown continued quarry operations for the production of crushed limestone at Morganville. No coal production was reported for Dade County in 1954.

Dawson.—C. M. Lyle Construction Co. produced sand from a pit near Dawsonville.

Decatur.—Minerals & Chemical Corporation of America, a new corporation formed by the merger of Edgar Bros. Co. and the Attapulgus Clay Co., continued to produce fuller's earth at the Attapulgus mine and plant.

De Kalb.—De Kalb County, producing crushed and dimension granite in the vicinity of Lithonia, ranked fourth in value of minerals produced in the State in 1954. Production was valued at $4 million, an increase of 24 percent above 1953. Six companies were active during the year. Consolidated Quarries, Inc., produced crushed stone, curbing, and rubble. Davidson Granite Co. quarried architectural stone, curbing, paving blocks, and rubble at the Pine Mountain quarries, and the Stone Mountain Grit Co. produced poultry grit, stone sand, and aggregates. Kellogg Granite Corp., Drew H. Kelly, and J. T. Reagan Granite Co. quarried curbing and rubble.

Dougherty.—Sand production in 1954 was 127,000 tons valued at $119,000. Albany Lime & Cement Co., Garrett Base Materials Products Co., Musgrove Sand Co., and Quick Service Sand Co. operated sand pits in the county in 1954.

Effingham.—Dawes Silica Mining Co., Inc., producing sand at the Eden pit, was the only mining operation in the county.

Elbert.—The production of dimension granite in 1954 was 501,000 cubic feet (43,400 tons) valued at $1.6 million, an increase of 11 percent in tonnage and 29 percent in value above 1953. Ten companies operated quarries in the vicinity of Elberton and produced monumental stone exclusively. Rough and dressed stone was produced by Comolli Granite Co., Elberton City Quarries, Inc., Elberton Granite Co., and Elberton Granite Industries, Inc. Rough monumental stone only was quarried by American Granite Quarries, Inc., Coggins Granite & Marble Industries, Inc., M. W. Kantola & Sons, George T. Oglesby Granite Co., Robin Blue Quarries, Inc., H. N. Spalding, and A. O. and M. H. Veal. R. V. Venable was the only producer of crushed granite. A small tonnage of scrap and sheet mica was produced by H. F. Alexander. Bond Sand & Gravel Co. also operated during the year.

TABLE 16.—Dimension granite sold or used by producers in Elbert County, 1950–54

Year	Short tons	Cubic feet	Value	Year	Short tons	Cubic feet	Value
1950 [1]	37,909	456,726	$1,277,510	1953	39,254	472,967	$1,212,089
1951 [1]	37,967	457,422	1,271,514	1954	43,398	501,174	1,561,490
1952 [1]	35,003	421,725	1,229,813				

[1] Revised figures.

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Evans.—Evans Concrete Products Co. produced sand from its pit near Daisy.

Fayette.—Tyrone Rock Products Co. produced crushed granite at its quarry at Tyrone in the northern part of the county.

Floyd.—The total mineral production in 1954 was valued at $354,000. Oconee Clay Products Co. and Rome Brick Co. mined shale for the manufacture of clay products. Crushed limestone was produced by the Ready Mix Concrete Co. and the Floyd County Highway Department; the latter also produced some dimension stone.

Franklin.—A small quantity of sheet mica was reported mined in the county in 1954.

Fulton.—Mineral production in Fulton County is limited to miscellaneous clay and sand and gravel, valued in 1954 at $136,000. Atlanta Brick & Tile Co. and the Chattahooche Brick Co. mined clay for their own use in manufacturing brick. J. D. Jones Sand & Gravel Co., C. J. Ross, and Thompson Bros. Sand Co. operated sand pits in the vicinity of Atlanta.

Gilmer.—Willingham-Little Stone Co. produced crushed limestone at Whitestone during the year.

Glascock.—Harbison-Walker Refractories Co. mined kaolin at the Gibson mine for manufacturing refractories.

Gordon.—Shale was mined by the Plainville Brick Co., Plainville, in the southwestern part of the county, for use in the manufacture of brick.

Grady.—Cairo Production Co. increased production of fuller's earth in 1954, and the Milwhite Co., Inc., of Houston, Tex., also reported mining fuller's earth during the year.

Greene.—W. M. Poss mined a small tonnage of feldspar and scrap mica from his property near Union Point.

Gwinnett.—Gwinnett County Highway Department produced 107,000 tons of crushed granite in 1954. No other mineral production was reported.

Hall.—A small quantity of sheet mica was mined by Wm. E. Hicks of Gainesville, Ga.

Hancock.—Weston & Brooker Co. operated its quarry at Granite Hill and produced 191,000 tons of crushed granite valued at $267,000.

Hart.—Funkhouser Co. at Hartwell expanded its production of flake mica more than 50 percent above 1953. Henry Grindstaff & Payne Bros. again reported production of sheet mica but in substantially smaller quantities than the previous year.

Henry.—Stockbridge Stone Co. increased production of crushed stone by more than 10 percent at its granite quarry near Stockbridge.

Houston.—Penn-Dixie Cement Corp. operated its limestone quarry and cement plant at Clinchfield, and the Georgia Limerock Co. produced crushed limestone, principally for agricultural use.

Jasper.—Appalachian Minerals Co. completed a new feldspar flotation mill near Monticello, replacing the former plant, which burned in 1951. The mill was put in operation late in the year and produced a small tonnage of feldspar.

Jones.—Grinstead Quarries at Haddock reported the production of 11,500 tons of crushed granite during 1954.

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Lamar.—Curtis Marable was the only producer of sheet mica in the county in 1954. Empire Mica Co. continued to explore the Harrison W. Harp mica mine under a DMEA contract for the exploration and development of strategic minerals. The total amount of the contract was $7,400, with Government participation of 90 percent.

Long.—Dawes Silica Mining Co. dredged building sand from its pit at Ludowici.

Lowndes.—Georgia Peat Moss Co., Inc., of Lake Park, was the only mineral producer in the county in 1954.

Macon.—American Cyanamid Co. operated the Norris and Pierce bauxite mines near Andersonville.

Madison.—Coggins Granite & Marble Industries of Elberton quarried granite, principally monumental stone, at the Piedmont quarry near Carlton.

Mitchell.—Davis Jenkins II reported the production of 10,000 tons of crushed limestone in 1954 from a quarry near Bridgeboro.

Monroe.—Sheet mica was the only mineral produced in the county. In 1954, 5 or more producers were active compared with 3 in 1953. Sales of sheet mica to the GSA depot at Spruce Pine, N. C., were 1,485 pounds valued at $21,640. The principal producers were Bruton & Howard and Copeland & Johnson, both of which operated the Battle mine during the year; O. H. Howell (Moye mine); and the Spalding Mining Co. (Thaddeus Persons mine). Two DMEA mica-exploration projects started in 1953 were in force during the year: Thomas Johnson continued exploration of the Thaddeus Persons mine, having taken over the contract of Howell & Anderson, and Homer C. Mundy explored the Dickens mine. The Johnson contract totaled $9,000 and the Mundy contract $3,100, the Government providing 90 percent of the costs in both contracts.

Montgomery.—H. H. Vandyke operated a small sand pit at Uvalda for the production of building sand.

Murray.—The production of crude talc and soapstone in 1954 was 50,500 tons valued at $177,000 compared with 58,000 tons valued at $203,000 in 1953. Before 1953 talc production was reported as sales of crude, sawed, and ground material, but beginning in 1953 the value of crude talc and soapstone mined is used at the production value. Cohutta Talc Co., Georgia Talc Co., and Southern Talc Co. operate mines east of Chatsworth in Fort Mountain and sawing and grinding plants in Chatsworth.

TABLE 17.—Production of crude and sales of ground talc and soapstone in Murray County, 1945–49 (average) and 1950–54

Year	Production (crude)		Sales (ground)		Year	Production (crude)		Sales (ground)	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1945–49 (ave.)	[1]	[1]	[2] 44,245	[2] $510,998	1952	58,411	[1]	56,181	$575,033
1950	70,749	[1]	70,552	681,030	1953	57,891	$202,619	57,581	594,900
1951	78,500	[1]	77,623	715,876	1954	50,536	176,876	50,248	505,219

[1] Data not available.
[2] Includes sawed material.

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Muscogee.—The value of mineral production in Muscogee County in 1954 was $933,000 compared with $514,000 reported in 1953. Crushed granite was produced by the Columbus Rock Co. and M–C Granite Co. from quarries a few miles north of Columbus. Ferguson Sand & Gravel Co. and J. J. Brown Sand & Gravel Co. operated pits near Baker Village, just south of Columbus.

Oconee.—Homer Mundy reported producing a small quantity of sheet mica in 1954.

Oglethorpe.—Production of dimension granite in 1954 was 23,300 tons valued at $766,000, an increase of 4 percent in tonnage and 44 percent in value above 1953. Quarries in the eastern part of the county between Lexington and Elberton were operated by Bennie & Harvey, Dixie Granite Co., Enterprise Granite Co., Hoover Granite Quarries, Inc., Liberty Granite Co., and Oglethorpe Quarrying Co.

TABLE 18.—Dimension granite sold or used by producers in Oglethorpe County, 1950–54

Year	Short tons	Cubic feet	Value	Year	Short tons	Cubic feet	Value
1950–51	(1)	(1)	(1)	1953	22,527	256,912	$533,135
1952	17,265	208,003	$368,655	1954	23,331	245,905	766,392

[1] Figure withheld to avoid disclosure of individual company operations.

Pickens.—Pickens advanced to second-ranking county in the State in value of its mineral production in 1954. The total value of minerals produced was $4.9 million—30 percent above the $3.7 million reported in 1953. Georgia Marble Co., with quarries and finishing plants at Tate, marketing dimension, crushed, and ground marble was the predominant producer in the county. Hardy Johnson and Carl Johnson both produced sandstone (flagstone). E. Easterwood mined flake mica (sericite) for the Thompson, Weinman Co., Cartersville, and Carl Stancel produced small quantities of beryl and sheet mica. Other small producers of sheet mica were Clayton Miller, P. & B. Mining Co., and Alex Teague. The Old Denson mica mine was explored under a DMEA contract by Alex Teague, the total amount of which was $2,994, with the Government providing 75 percent of the total spent on the exploration.

Pike.—Marable & Weldon of Milner mined sheet mica, and Julius McGee of Zebulon produced peat.

Polk.—The total mineral production in Polk County in 1954 was down slightly more than 1 percent below 1953. Iron-ore production, approximately only one-half of that in 1953, accounted for the decline, although increased production of cement (9 percent) and new production of slate were added during the year. The Marquette Cement Manufacturing Co., which purchased the Southern States Portland Cement Co. at Rockmart, effective January 1, 1954, continued to operate that plant and mined limestone and clay principally for its own use. Iron-ore production dropped to 72,600 tons valued at $305,000 from 146,700 tons with a value of $652,000 in 1953, decreases of 50 and 47 percent in tonnage and value. Iron-ore producers during the year were: Albea York Mining Co., E. L. Gam-

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mage, Graves & Acree, and Woodward Mines, all of Cedartown. Georgia Lightweight Aggregates Co. mined slate for the production of lightweight aggregates at Rockmart.

TABLE 19.—Shipments of brown iron ore in Polk County, 1950–54

Year	Long tons	Value	Year	Long tons	Value
1950	96,272	$317,420	1953	146,690	$652,306
1951	140,355	541,929	1954	72,635	304,682
1952	165,522	822,802			

Quitman.—Worthy-Smilax Co. shipped a small tonnage of brown iron ore during 1954.

Rabun.—Powhatan Mining Co. continued mining asbestos from the Cornelia mine near Dillard.

Richmond.—Mineral production in 1954 totaled $1.6 million compared with $2.4 million for the previous year, a decline of 35 percent. The output of kaolin, quartzite, and sand was below 1953, and although greater tonnages of miscellaneous clay were mined their value was also lower. Producers of miscellaneous clay for use in manufacturing clay products were: Georgia-Carolina Brick & Tile Co. and Merry Bros. Brick & Tile Co., both of Augusta. The Albion Kaolin Division of Interchemical Corp. mined refractory kaolin at Hepzibah. Superior Stone Co. produced crushed quartzite at the Dan quarry, and Richmond Sand Co. was also active during the year.

Screven.—Atlantic Peat Co., Sylvania, was the only mineral producer in the county during the year.

Spalding.—A small quantity of sheet mica produced in the county was sold to the GSA buying depot at Spruce Pine, N. C.

Stephens.—Toccoa Construction Co. quarried 43,000 tons of granite valued at $79,000 during 1954.

Talbot.—Taylor Sand Co. continued to operate its sand pit south of Junction City.

Taylor.—Brown Bros. increased production of sand from their pit near Howard.

Telfair.—Walker's Sand Pit north of Lumber City produced sand for local use.

Thomas.—Mineral producers in 1954 were: Arnold Brick Co., Thomasville, miscellaneous clay for manufacture of brick; and Dawes Silica Mining Co., Dawesville, washed sand and ground silica sand.

TABLE 20.—Production of ground sand in Thomas County, 1950–54

Year	Short tons	Value	Year	Short tons	Value
1950	1,176	$11,760	1953	(1)	(1)
1951	1,874	18,740	1954	(1 2)	(1 2)
1952	1,765	17,650			

[1] Figures withheld to avoid disclosure of individual company operations.
[2] Included with "Sand and gravel" in 1954.

Troup.—Mineral Processing Co., operating the Hogg mine near La Grange, was an important producer of beryl in 1954.

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Twiggs.—Twiggs County ranked first in value of mineral production in 1954. The output of kaolin, the only mineral produced, was 750,000 tons valued at $12.5 million, 54 percent higher in tonnage than 1953. Companies active in 1954 were: Diversey Corp., Pikes Peak, Georgia Coating Clay Co., Macon; Georgia Kaolin Co., Dry Branch; J. M. Huber Co., Huber; and Southern Clays, Inc., Gordon.

TABLE 21.—Kaolin sold or used by producers in Twiggs County, 1950–54

Year	Short tons	Value	Year	Short tons	Value
1950	496,256	$6,888,008	1953	[1] 486,371	[2]
1951	541,974	7,611,121	1954	750,441	$12,543,077
1952	521,077	7,487,877			

[1] Revised figure.
[2] Figure withheld to avoid disclosure of individual company operations.

Union.—The only mineral activity in the county in 1954 was the exploration of the Lake Tralyta property for strategic mica under a DMEA contract by the Tralyta Mining Co. The total amount of the contract was $5,716, with Government participation of 75 percent.

Upson.—Upson County output of sheet mica, although only 25 percent of the State total production, was 72 percent of the total value and more than doubled the value in 1953. The J. & B. Mining Co. (Adams mine), Yatesville, and Luther N. Johnson (Mauldin mine), Barnesville, were the principal producers. Other producers of sheet mica included: T. M. Elliott, Thomaston; Curtis Marable, Milner; and H. Lee Medford and Yatesville Mining Co., Yatesville. Only a few tons of scrap mica was reported in 1954. Two DMEA mica-exploration projects started the previous year were continued in 1954; the Empire Mica Co. explored the Short-Mitchell mine and C. R. Phillips the J. H. Reynolds mine. The contract of the Empire Mica Co. was $8,600 and C. R. Phillips $6,650, with Government participation of 90 percent in both contracts.

Walker.—Crushed limestone was produced by the Dave L. Brown Co. at Rossville and the Limestone Products Co. at Chickamauga. Willard Parker and the H. R. Perry Stone Co. quarried dimension limestone, principally for residential construction near Chickamauga. W. J. Coulter shipped 217 tons of red iron ore. Coal production reported from the county in 1954 was 8,090 tons valued at $40,450.

Ware.—E. W. Pafford dredged sand near Waycross for local use, principally building purposes.

Warren.—Weston & Brooker Co. continued to operate the Camak quarry for production of crushed granite.

Washington.—Washington held its place as the third most important mineral-producing county in the State with reference to value. Output of kaolin, the only mineral produced, was 264,000 tons valued at $4.2 million, a decrease of 13 percent in both tonnage and value from the 302,000 tons valued at $4.8 million in 1953. Producers were Champion Paper & Fibre Co., Georgia Pigment Co., Thiele Kaolin Co., United Clay Mines Corp., and Minerals & Chemical Corporation of America (the latter a new corporation formed by the merger of

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Edgar Bros. Co., a long-established producer in both Washington and Wilkinson Counties and Attapulgus Clay Co., producer of fuller's earth in Decatur County).

TABLE 22.—Kaolin sold or used by producers in Washington County, 1950–54

Year	Short tons	Value	Year	Short tons	Value
1950	237, 995	$3, 606, 656	1953	302, 250	$4, 768, 916
1951	255, 334	3, 952, 849	1954	264, 195	4, 162, 386
1952	259, 977	4, 069, 357			

Whitfield.—Dalton Brick & Tile Co. mined shale for the manufacture of brick near its plant south of Dalton and Copper & Maples quarried crushed limestone northeast of Dalton.

Wilkinson.—Kaolin production in 1954 was 241,000 tons valued at $3.7 million compared with 454,000 tons valued at $7.5 million in 1953. Producers were Evans Clay Co., D. C. Hardie, M. & M. Clays, Inc., Minerals & Chemical Corp. (formerly Edgar Bros. Co.), Oconee Clay Products Co., Savannah Kaolin Co., and Harbison-Walker Refractories Co. Production of Southern Clays, Inc., previously reported in Wilkinson County, is included in Twiggs County.

TABLE 23.—Kaolin sold or used by producers in Wilkinson County, 1950–54

Year	Short tons	Value	Year	Short tons	Value
1950	392, 357	$6, 338, 763	1953	454, 000	$7, 467, 181
1951	402, 328	6, 465, 212	1954	241, 198	3, 692, 143
1952	435, 528	6, 639, 300			

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The Mineral Industry of Hawaii and Pacific-Island Possessions

By John D. McLenegan [1]

HAWAII

THE TOTAL VALUE of mineral production in the Hawaiian Islands in 1954 was $3.6 million compared with $3.3 million in 1953. Hawaii's mineral industry in 1954 comprised stone quarrying; the preparation of lime, sand and gravel, and volcanic cinders; and the production of clays and salt (sodium chloride). Some production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

The possibilities of utilizing titaniferous and manganiferous soils and industrial clay deposits and of recovering magnesium salts from sea water in Hawaii were described by Sherman.[2] Weathering conditions in Hawaii are similar to other tropical and subtropical regions where iron ore, bauxite, chromium, nickel, and manganese are found in lava rocks in commercial quantities. Although these materials occur in the Hawaiian Islands, the mineral resources have been considered to be limited to coral sand, clays, lime, and crushed lava rock.

CONSUMPTION AND MARKETS

All minerals produced in Hawaii in 1954 were consumed in the Territory; this output, however, was only a small part of the islands' mineral requirements. Petroleum, petroleum products, cement, and fertilizer materials comprised a large percentage of the mineral commodities imported.

EMPLOYMENT IN THE MINERAL INDUSTRY

The average number of persons employed in Hawaii at mining and quarrying operations during 1954 was 210. The average weekly wages of mineral-industry employees in 1954 was $63.60 compared with $69.40 in 1953, $63.01 in 1952, and $65.98 in 1951.[3]

[1] Commodity-industry analyst, Region II, Bureau of Mines, San Francisco, Calif.
[2] Sherman, G. Donald, Some of the Mineral Resources of the Hawaiian Islands: Hawaii Agric. Exper. Sta., Special pub. 1, June 1954, pp. 1–17.
[3] Data furnished by the U. S. Department of Labor, Bureau of Employment Security.

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TABLE 1.—Mineral production in Hawaii and Pacific-Island possessions, 1953–54[1]

Area and mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
American Samoa:				
Sand	[2] 1,320	[2] $425	1,800	$675
Stone (crushed)	[2] 74,750	[2] 16,500	57,600	15,000
Total		[2] 17,000		16,000
Canton: Stone (crushed)	4,200	8,750	2,600	5,000
Guam: Stone (crushed)	2,080,650	5,573,169	842,660	2,275,182
Hawaii:				
Lime (open-market)	7,431	223,575	8,375	251,610
Sand and gravel	110,558	156,853	119,121	318,754
Stone	[3] 1,518,649	[3] 2,918,423	[4] 1,485,427	[4] 2,993,032
Undistributed: Clays, salt, pumice, and pumicite (volcanic cinders)		33,409		58,778
Total		3,332,000		[5] 3,596,000
Johnston: Stone (crushed)			98	300
Midway: Stone (crushed)	204	638	490	1,500
Wake: Stone (crushed)	11,980	20,615	780	1,300

[1] Production data for Canton and Wake furnished by the U. S. Department of Commerce, Civil Aeronautics Administration; Midway and Johnston, by the U. S. Department of the Navy; Guam, by the Government of Guam; American Samoa, by the Government of American Samoa.
[2] Estimate.
[3] Excludes limestone used in lime.
[4] Includes limestone used in lime.
[5] The total has been adjusted to eliminate duplication in the value of limestone used in lime.

REVIEW BY MINERAL COMMODITIES

Clays.—Wilsonite Brick Co., Ltd., produced miscellaneous clays at Honolulu, Honolulu County, Oahu, for brick and tile. Gaspro, Ltd., formerly Hawaiian Gas Products, Ltd., also produced miscellaneous clays on Oahu for tile and pottery.

Lime.—Gaspro, Ltd., at Honolulu, prepared mason's quicklime and hydrated line and produced hydrated lime for chemical use.

Sand and Gravel.—The National Park Service prepared sand and gravel for paving in Hawaii County on the Island of Hawaii. The Honolulu Construction & Draying Co., Ltd., produced sand for building construction at Kahuku on Oahu.

Salt.—Chun Mew Ting Co. produced salt from sea water by solar evaporation at Honouliuli, Honolulu County, Oahu.

Stone.—Basalt limestone and volcanic cinders were mined in Hawaii in 1954. Before 1954 production of limestone for lime was excluded from the stone production total. To permit a comparison of 1953 and 1954 stone data in table 1, output of limestone used in lime in 1954 was 18,293 tons valued at $25,717.

Stone.—*Basalt.*—Basalt was quarried and crushed by the following companies on Oahu in Honolulu County for concrete, road metal, riprap, and miscellaneous uses: Clarke-Halawa Rock Co., Ltd., at Halawa; Hawaiian Rock & Supply Co., Ltd., and Pacific Concrete & Rock Co., at Honolulu; Honolulu Construction & Draying Co., Ltd., at Kailua; and Nanakuli Paving & Rock Co., at Nanakuli. In Hawaii County, Hawaii, Honolulu Builders, Ltd., and James W. Glover, Ltd., produced basalt for concrete and road metal. Grove Farms Co., Ltd., crushed basalt for concrete and road metal from their quarries on Kauai. In Maui County, Maui, the Kahului Railroad

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Co. and Molokai Rock & Equipment Co. quarried basalt for concrete and road metal.

Limestone.—Gaspro, Ltd., operated its quarry at Waianae, in Honolulu County, Oahu, and produced limestone for lime, carbon dioxide gas manufacture, and aggregate material. Limestone was crushed at Lanikai by Kailua Limestone Co. for aggregates and miscellaneous uses. Grove Farms Co., Ltd., on Kauai crushed limestone for concrete and road metal.

Volcanic Cinders.—Walker-Moody Construction Co., Ltd., produced crude and prepared volcanic cinders for aggregates at Makiki Heights, Oahu.

PACIFIC-ISLAND POSSESSIONS

AMERICAN SAMOA

Coral was quarried for roads and fills, and coral sand was utilized for aggregates. Both crushed basalt and basalt fines were produced for concrete aggregate.

CANTON

Graded coral was prepared by the Civil Aeronautics Administration for concrete and asphalt aggregates used in paving projects on the Island.

GUAM

Coral was quarried and crushed by contractors for concrete aggregate, road base, and fills.

JOHNSTON

A small production of coral was used for aggregate.

MIDWAY

There was a minor production of coral aggregate for construction purposes.

WAKE

Pan American World Airways and the Civil Aeronautics Administration produced graded coral aggregate for use in concrete and asphalt paving.

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The Mineral Industry of Idaho

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Idaho Bureau of Mines and Geology.

By Kenneth D. Baber,[1] Frank B. Fulkerson,[1] and Albert J. Kauffman, Jr.[2]

MINING of silver, lead, zinc, and other metals continued to supply most of the mineral-production value of Idaho, but the depressed state of lead-zinc mining and growing activity in nonmetallic construction and industrial materials, particularly in phosphate-rock processing, together with expanded statistical coverage of the sand and gravel industry, reduced the wide disparity between the metal and nonmetal values. The total value of mineral production was $69.7 million compared with $67.1 million in 1953. Silver, lead, and zinc composed 67 percent of the value of minerals produced compared with 74 percent in 1953, and the share contributed by all metals dropped to 77 percent as against 82 percent in the previous year. Lead continued to be the principal product. For the first time since 1940, zinc dropped to third place behind silver after a sharp decline in output. Other values in excess of $1 million were credited to cement, copper, cobalt, phosphate rock, sand and gravel, stone, and tungsten. The production of phosphate rock exceeded 1 million tons for the second consecutive year and increased 9 percent over 1953. Mining and manufacturing operations based on the phosphate beds in eastern Idaho now make up one of the leading industries in that part of the State; possibilities for further development in this growing industry can be seen in the fact that Idaho has an estimated 43 percent of the phosphate reserves in the United States and more than 72 percent of the phosphate tonnage in the western fields. In 1954 Monsanto Chemical Co. doubled mine output from the Ballard property in Caribou County and completed installation of a second electric furnace at the Soda Springs plant. Much of the $1.8 million increase in sand and gravel output was due to better statistical coverage of commercial producers. Through the cooperation of the industry the sand and gravel mailing list was expanded greatly in 1954.

[1] Commodity-industry analyst, Region I, Bureau of Mines, Albany, Oreg.
[2] Chief, Division of Mineral Industries, Region I, Bureau of Mines, Albany, Oreg.

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TABLE 1.—Mineral production in Idaho, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Antimony ore and concentrate---gross weight	(2)	(2)	4,682	(2)
Beryllium concentrate	1	$491	(2)	(2)
Clays	26,229	21,339	(2)	(2)
Cobalt (content of ore)---pounds	1,211,039	(2)	1,702,272	(2)
Copper (recoverable content of ores, etc.)	3,136	1,800,064	4,828	$2,848,520
Gold (recoverable content of ores, etc.)---troy ounces	17,630	617,050	13,245	463,575
Gypsum	150	450	(2)	(2)
Lead (recoverable content of ores, etc.)	74,610	19,547,820	69,302	18,988,748
Mercury---76-pound flasks	(2)	(2)	609	161,013
Mica: Sheet---pounds	24,216	223,266	(2)	(2)
Nickel ore---do	21,254	(2)	25,726	(2)
Peat			500	(2)
Phosphate rock---long tons	1,001,969	4,149,943	1,092,817	5,686,609
Pumice and pumicite	85,224	159,833	(2)	(2)
Sand and gravel	3,776,180	2,841,440	6,717,700	4,568,919
Sand and sandstone (ground)	5,304	43,865	(3)	(3)
Silver (recoverable content of ores, etc.)---troy ounces	14,639,740	13,249,704	15,867,414	14,360,811
Stone (except limestone for cement)	1,141,626	2,260,875	2,329,005	3,012,613
Titanium-iron concentrate (nontitanium use)	1,585	7,500		
Tungsten concentrate---60-percent WO_3 basis	441	1,665,983	471	(2)
Zinc (recoverable content of ores, etc.)	72,153	16,595,190	61,528	13,290,048
Undistributed: Barite, cement, columbium-tantalum concentrate (1952), abrasive garnet, fluorspar (1953), scrap mica (1954), quartz (1953), vanadium, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote 2)		[4] 3,814,751		[5] 6,312,007
Total Idaho		[4] 67,000,000		69,693,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Value included with "Undistributed."
[3] Beginning with 1954 sand and sandstone (ground) included with sand and gravel or stone.
[4] Revised figure.
[5] Excludes value of raw material used in the manufacture of cement.

Although there were no widespread tieups in mining during the year because of strikes, employment at mines and quarries averaged only 4,500. This was 300 under the 1953 average and 1,100 under 1952, reflecting the decline in lead-zinc mining because of low prices. Employment records showed that fewer workers were employed at mining operations than at any time since 1945. The monthly totals for 1954 ranged from a low of 4,300 in January–March to a high of 4,800 in July. Data of the Idaho Employment Security Agency also disclosed the decrease in average weekly earnings because of a shorter workweek. In July gross hourly earnings, computed to show overtime and night-shift pay as well as basic hourly and incentive wage rates, were about the same at $2.12 as the year before, but the workweek averaged only 39.9 hours as against 42.2 hours in July 1953. The result was that the average weekly earnings for the month declined from $89.04 in July 1953 to $84.59 in July 1954. Figures for the remainder of the year showed a similar decrease. Despite this decrease, weekly wages in mining were higher than in other fields except the seasonal logging and construction industries. Contract construction also declined in employment in 1954, averaging 8,300 men compared with 8,700 in 1953. Construction employment reached its peak in 1951 during work on the atomic plant at Arco and declined in each of the next 3 years.

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Additional details on wages and employment in the mineral industry are given in tables 2 and 3. Metal production provided nearly all the employment in mining in 1954, with lead- and zinc-ore mining composing a large share of the total. Of the average of 4,500 workers in mining, about 4,200 were in metal mining (2,700 in lead- and zinc-ore mining) and 300 at nonmetallic mines and quarries. The number of workers at mines has decreased since 1947, dropping from 5,700 in that year to 4,500 in 1954.

Mining industries accounted for 5 percent of covered employment in Idaho and 16 percent of the employment in the industrial production fields (manufacturing and mining). Mining payrolls totaled $21 million in 1954 as compared with $18.8 million in 1947. The peak in payrolls was reached in 1952, when there was an average of 5,600 workers and payrolls totaled $26.1 million.

In mineral manufacturing, data provided by the Idaho Employment Security Agency showed that in 1954 the average employment in smelting, refining, and casting was 1,100. Manufacturing of chemical and allied products also was important in the State economic picture, with 500 workers employed in manufacturing industrial inorganic chemicals and 200 in the fertilizer industry. Stone and clay products, including cement, employed 400 people.

TABLE 2.—Employment in mining and mineral manufacturing industries in Idaho, 1947–54 [1]

	1947	1948	1949	1950	1951	1952	1953	1954
Mining:								
Metal	5,439	5,221	5,073	5,280	5,236	5,231	4,479	4,206
Bituminous coal	2	14	15	2	1	1	10	6
Crude petroleum and natural gas			17	15	2	23	4	3
Nonmetallic and quarrying	263	218	204	255	272	307	326	283
Total mining	5,704	5,453	5,309	5,552	5,511	5,562	4,819	4,498
Mineral manufacturing:								
Stone and clay products	313	328	372	395	409	406	391	385
Primary metals	568	1,226	998	1,131	1,094	1,097	1,041	1,147
Chemicals and allied products	51	76	137	272	524	1,054	757	796
Total mineral manufacturing	932	1,630	1,507	1,798	2,027	2,557	2,189	2,328

[1] Employment covered by Idaho Employment Security Act. Compiled from State Employment Security Agency tabulations.

Employment in all fields of mineral manufacturing increased from 1947 to 1954. Primary metals advanced from 600 workers to 1,100, chemicals and allied products increased from only 50 workers to 800 (this area included a small number of workers at plants not classified as mineral manufacturing), and stone and clay-products employment gained from 300 to 400. Mineral manufacturing supplied about 10 percent of all employment in manufacturing industries of Idaho in 1954.

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TABLE 3.—Wages paid in mining and mineral manufacturing industries in Idaho, 1947–54 [1]

	1947	1948	1949	1950	1951	1952	1953	1954
Mining:								
Metal	$18,100,322	$18,952,216	$19,272,283	$21,039,850	$22,170,789	$24,580,580	$21,835,855	$19,753,622
Bituminous coal	1,399	31,963	38,996	6,211	5,489	3,218	18,489	6,763
Crude petroleum and natural gas			11,905	64,354	7,425	150,424	8,734	5,027
Nonmetallic and quarrying	736,370	702,137	644,800	841,742	1,026,720	1,327,175	1,374,802	1,204,006
Total mining	18,838,091	19,686,316	19,967,984	21,952,157	23,210,423	26,061,397	23,237,880	20,969,418
Mineral manufacturing:								
Stone and clay products	806,978	926,331	1,121,793	1,249,193	1,466,823	1,484,672	1,524,228	1,499,787
Primary metals	1,840,757	4,611,195	3,544,727	4,488,424	4,732,661	5,382,504	4,800,556	5.214,121
Chemicals and allied products	128,030	236,074	479,572	1,036,433	2,193,432	4,774,938	3,372,287	3,614,231
Total mineral manufacturing	2,775,765	5,773,600	5,146,092	6,774,050	8,392,916	11,642,114	9,697,071	10,328,139

[1] Wages in employment covered by Idaho Employment Security Law. Compiled from State Employment Security Agency tabulations.

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From 1947 to 1954, primary metals payrolls increased from $1.8 million to $5.2 million, chemicals and allied products payrolls advanced from $130,000 to $3.6 million, and stone and clay products payrolls increased from $807,000 to $1.5 million.

The State Dredge Mining Protective Act, which originally was sponsored as an initiative measure by the Idaho Wildlife Federation, was to become law in January 1955 after being passed in the general election in November 1954. The act, administered by the State board of land commissioners, applied to placer mining operations capable of moving 500 cubic yards of gravel per day. It required that operators smooth over after mining and restore watercourses disturbed in dredging to pool structures conducive to fish and wildlife and recreational use. Dredge-mining operators also were required to construct settling ponds to clarify water used in mining before the water is discharged into the streams. Any person conducting dredging operations was obliged to apply to the board for a permit, pay a fee of $50 for each 50 acres involved in the application, and file a surety bond of $300 for each acre of land to be dredged. If an operator failed to comply with the provisions of the act, the bond was forfeited to the State. The Idaho Dredge Operators Association, formed early in the year to oppose passage of the initiative, claimed that stream-pollution control had already begun under a 1953 law administered by the State mine inspector and cited improvements, such as the $13,000 water-clarification project on the Payette River below Cascade, as evidence that the newer law was not required.

In addition to the mineral values credited to Idaho in table 1, some are not included owing to lack of information. Many ores contain valuable minor constituents, such as arsenic, bismuth, cadmium, selenium, tellurium, gallium, and germanium. The quantities sometimes are not known and sometimes, though known by analyses, are not accounted for metallurgically in early processing stages or credited to mine or origin. These minor constituents are recovered at plants that frequently treat mixtures of materials from many sources, including residues obtained from refining such metals as copper and lead and those obtained in other ways. It is not possible in many such instances to distribute the mineral product by States of origin, and sometimes it is even difficult to obtain an accurate separation as to domestic and foreign sources. Another mineral product of value, the production of which usually cannot be separated as to source, is byproduct sulfuric acid. The value of monazite produced cannot be credited, inasmuch as such information is not available for publication under existing regulations of the Atomic Energy Commission.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

Government Assistance Under DMEA.—Table 4 shows active projects in the Defense Minerals Exploration Administration (DMEA) program to assist in the systematic investigation of strategic and critical mineral occurrences.

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TABLE 4.—Defense Minerals Exploration Administration contracts active during 1954

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
BANNOCK					
J. R. Simplot Co	Vanza	Manganese	Sep. 24, 1953	$34,600	75
BLAINE					
E. H. Sowers and Stanley G. Johnson.	Red Leaf	Lead, zinc	Oct. 19, 1954	10,662	50
Triumph Mining Co	Triumph	do	Aug. 9, 1954	143,354	50
BONNER					
Whitedelf Mining & Development Co.	Whitedelf	Lead	Oct. 19, 1951	232,950	50
CUSTER					
Joseph L. Ausich	Champion	Lead, zinc	June 30, 1952	39,510	50
Louis Buchman, L. S. Breckon, & J. A. Norden.	Red Bird	Lead, silver	Feb. 28, 1952	58,990	50
Elmer Enderlin and Henry Connolly.	Meadow View	Zinc	Apr. 16, 1952	27,120	50
Idaho Custer Mines	Livingston	Lead, zinc	July 28, 1953	97,737	50
LEMHI					
Bradley Mining Co	Ima	Tungsten	Oct. 28, 1952	136,000	75
Calera Mining Co	Blackbird	Cobalt, copper	Dec. 9, 1953	407,340	70
Centrida Mines, Inc	Pope-Shenon	Copper	Dec. 28, 1953	63,140	50
Defense Metals, Inc	Wonder	Thorium, uranium.	Aug. 8, 1952	68,265	90
Montana Coal & Iron Co	Black Pine	Cobalt, copper	June 25, 1953	88,850	70
Northfield Mines, Inc	Stevenson	do	June 2, 1952	233,150	70
Roger V. Pierce	Gilmore	Lead, zinc	July 27, 1953	64,145	50
I. J. Wilhite and Arthur V. Seay.	Surprise	Uranium	Sep. 28, 1954	16,000	75
SHOSHONE					
Bunker Chance Mining Co	Bunker Chance	Copper, lead	Apr. 1, 1952	152,530	50
Bunker Hill & Sullivan Mining & Concentrating Co.	Crescent	Lead, zinc, copper	Feb. 25, 1953	1,098,750	50
Day Mines, Inc	Hercules	do	Feb. 5, 1953	288,710	50
Golconda Lead Mines	Golconda	do	Jan. 14, 1953	90,000	50
Hecla Mining Co	Hecla-Silver Mountain.	do	Oct. 21, 1954	1,058,370	50
Highland-Surprise Consolidated Mining Co.	Highland-Surprise.	Lead, zinc	Apr. 1, 1953	282,110	50
Hypotheek Mining & Milling Co.	East Hypotheek	do	Aug. 4, 1952	70,410	50
Idaho Mining Co	Washington-Idaho.	do	May 26, 1953	122,572	50
North Fork Mining Co	Lucky Strike	do	Jan. 2, 1953	44,500	50
North Idaho Mines, Inc	Pony	Tungsten	do	13,200	75
Polaris Mining Co	Polaris East Exploration.	Copper, lead, antimony.	June 3, 1953	685,955	50
Sidney Mining Co	Sidney	Lead, zinc	July 3, 1952	523,440	50
Signal Mining Co	New Hilarity	do	Oct. 16, 1952	21,000	50
Silver Buckle Mining Co	Vindicator	do	Oct. 12, 1953	229,500	50
Spokane-Idaho Mining Co	Douglas	do	Jan. 30, 1953	142,634	50
VALLEY					
Bradley Mining Co	Yellow Pine	Antimony	Feb. 27, 1953	175,368	75
Do	do	do	Nov. 25, 1952	53,000	75
McRae Tungsten Corp	Red Bluff	Tungsten	Sep. 25, 1952	53,800	75

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REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—As in 1953, the only antimony produced in the State, excluding antimony contained in antimonial lead, was recovered from ores treated by the Sunshine Mining Co. at its facilities near Kellogg, Shoshone County. The company annual report stated that output exceeded 1,600,000 pounds of cathode metal containing 1,527,360 pounds of antimony and that the antimony content of metal stockpiled at the plant amounted to 2,250,160 pounds at the close of the year.

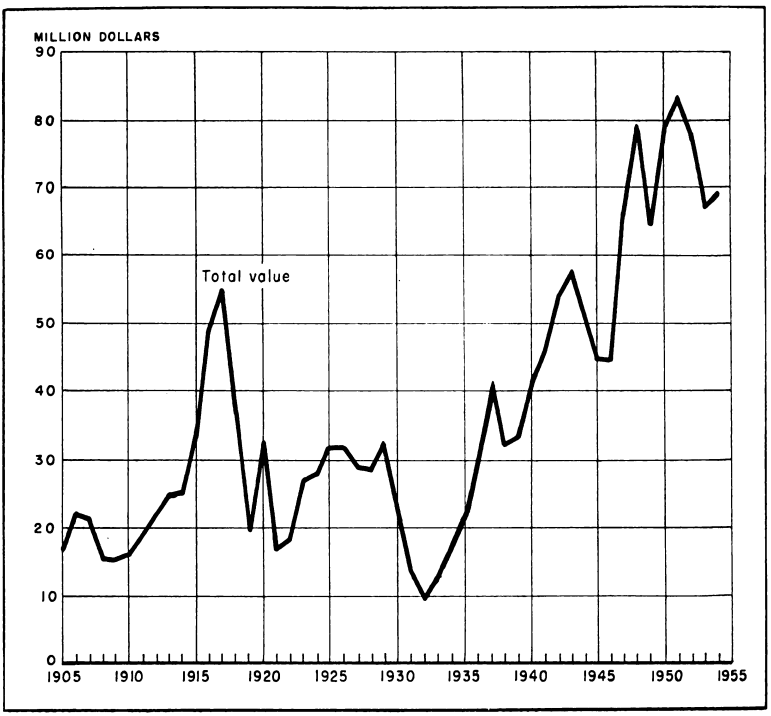

FIGURE 1.—Value of mineral production in Idaho, 1905–54.

Smelter penalties for excessive antimony content in the company bulk concentrate, produced from ores from the Sunshine mine as well as from neighboring properties operated by the company on a profit-sharing basis, were a principal factor in the decision to reopen the electrolytic plant in April 1953. The plant previously had been operated during World War II. All output during 1953 and 1954 was stockpiled, pending a suitable market. A detailed description of the operation of the electrolytic plant was published.[3]

[3] Gould, Wayne D., The Production of Antimony: Western Miner and Oil Review, vol. 27, No. 2, February 1954, pp. 42–43.

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Mines throughout the lead-silver-zinc-producing area of northern Idaho continued to add to the domestic antimonial-lead production. Antimony in antimonial lead, however, is not included in the State or national mineral-production totals.

At the Bradley Mining Co. Yellow Pine property in Valley County, exploration and development were carried on under two DMEA projects. The mine, formerly the principal domestic source of antimony, was closed in mid-1952 because of an unfavorable market.

Beryllium.—Concentrate containing approximately 10 percent beryllium oxide was shipped by the Idaho Beryllium & Mica Corp. to the General Services Administration (GSA) purchase depot at Custer, S. Dak., during the year. The concentrate was recovered as a byproduct from mica-bearing material produced by the company from the Muscovite mine near Deary, Latah County.

Cadmium.—Cadmium metal was produced as a byproduct from lead and zinc ores processed in the Bunker Hill & Sullivan Mining & Concentrating Co. smelter and the Sullivan Mining Co. electrolytic zinc plant in Shoshone County. Company annual reports for 1954 record production of 40,466 pounds of cadmium at the Bunker Hill smelter, compared with 125,546 pounds in 1953, and 389,360 pounds at the Sullivan electrolytic zinc plant, as against 521,340 pounds the previous year. Cadmium is not included in State or national mineral production totals (see par. 9 in introduction).

Cobalt.—The output of cobalt concentrate at the Blackbird mine, Lemhi County, by Calera Mining Co., increased substantially in 1954 although operations at the mine continued on a standby basis. The 1954 annual report of the Howe Sound Co., of which Calera Mining Co. is a subsidiary, stated that production was increased early in the year in anticipation of greater consumption at the company refinery in Garfield, Utah. Production was later reduced to about 55 percent of capacity after buildup of a substantial inventory of concentrate. Exploration and development were carried on at the Blackbird property under a DMEA project; Montana Coal & Iron Co. also conducted a DMEA project for cobalt at its nearby Black Pine mine.

According to the Calera Mining Co. annual report, output from the Garfield refinery totaled 735,674 pounds of cobalt in metallic form. Granules containing 631,397 pounds of cobalt and 25,726 pounds of nickel were shipped. Due to technical difficulties encountered at the refinery, Chemical Construction Corp., builders of the plant, agreed to manage and operate the facility for a 2-year period. Concentrate was to be processed for the Calera Mining Co. on a toll basis, and efforts were to be directed toward solving the technical difficulties and placing the operation of the refinery on a commercial basis.

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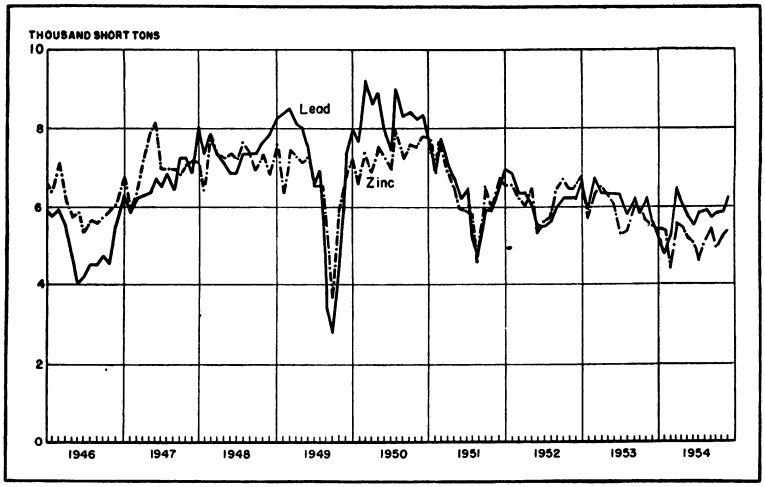

FIGURE 2.—Mine production of lead and zinc in Idaho, 1946–54, by months, in terms of recoverable metals.

Copper.—Production of this metal increased 54 percent owing largely to advances in output from the Blackbird mine (copper-cobalt ore) of Calera Mining Co. in Lemhi County and the Sunshine mine (silver ore) of Sunshine Mining Co. in Shoshone County. The Blackbird mine, the largest producer in the State, was under development and in partial production throughout 1954. The Galena mine (silver ore), Shoshone County, operated by American Smelting & Refining Co., also yielded a larger quantity of copper in 1954 and was the third largest producer. Other properties supplying byproduct copper included, in order of output, Silver Summit (silver ore), Shoshone County; Bunker Hill (lead-zinc ore), Shoshone County; Ima (tungsten ore yielding copper-lead concentrates), Lemhi County; Lucky Friday (lead-zinc ore), Shoshone County; and Star (lead-zinc ore), Shoshone County. Copper ore in varying quantities was shipped from the Copper Mountain mine, Butte County; Empire property, Custer County, Grandview mine, Lemhi County; and South Mountain mine, Owyhee County. In Custer County copper-lead-zinc ore was shipped from the Mackinac and Comanche group of claims, and copper-lead ore was produced from the Ramshorn mine. Of the total copper produced, 46 percent was derived from silver ore, 44 percent from copper ore, and most of the remainder from lead-zinc ore.

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Gold.—The 25-percent decline in gold production reduced the annual yield of the metal to the lowest point in State history. Records show that only in 1926, when 13,670 ounces was recovered, did the production of gold drop to an amount comparable to the 1954 output of 13,245 ounces. After 1950 production of gold declined steadily owing to depletion of deposits that could be operated profitably in view of increased operating costs and the fixed price for the metal. At the end of 1953 Duvall Co. terminated its lease operation at the Virginia group of lode claims in the Blackpine district, Cassia County, because of advanced ore depletion; this was the principal factor behind the drop in the Idaho total for 1954, as the Virginia group, although a comparatively small operation, was the largest producer in the State.

Lode-mine output, which declined 44 percent, supplied less than half of the total production in 1954. About 37 percent came from gold and gold-silver ores, 28 percent from lead-zinc ore, 22 percent from copper ore, and most of the remainder from silver ore. The Talache Mines, Inc., Boise-Rochester group (gold ore) in Elmore County and the Calera Mining Co. Blackbird mine (copper-cobalt ore) in Lemhi County were the largest producers.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc, 1945–49 (average), 1950–54, and total, 1863–1954, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945–49 (average)	161	71	3,355,618	52,404	$1,834,140	9,295,536	$7,970,996
1950	155	75	3,300,215	79,652	2,787,820	16,095,019	14,566,805
1951	157	52	3,254,791	45,064	1,577,240	14,753,023	13,352,231
1952	132	29	3,008,230	32,997	1,154,895	14,923,165	13,506,218
1953	114	34	2,090,185	17,630	617,050	14,639,740	13,249,704
1954	101	23	1,960,962	13,245	463,575	15,867,414	14,360,811
1863–1954 [3]	-------	-------	129,069,000	8,230,602	191,210,473	628,607,684	456,887,587

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	1,458	$542,892	75,044	$20,868,632	80,172	$19,735,912	$50,952,571
1950	2,107	876,512	100,025	27,006,750	87,890	24,960,760	70,198,647
1951	2,160	1,045,440	76,713	26,542,698	78,121	28,436,044	70,953,653
1952	3,213	1,555,092	73,719	23,737,518	74,317	24,673,244	64,626,967
1953	3,136	1,800,064	74,610	19,547,820	72,153	16,595,190	51,809,828
1954	4,828	2,848,520	69,302	18,988,748	61,528	13,290,048	49,951,702
1863–1954 [3]	127,933	43,042,895	6,581,540	851,194,910	1,913,572	381,219,271	1,923,555,136

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings and old slag re-treated, and ore shipped to smelters during the calendar year indicated.
[2] Does not include gravel washed.
[3] Partly estimated for years before 1901.

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TABLE 6.—Gold produced at placer mines, 1945–49 (average) and 1950–54, by classes of mines and methods of recovery

Class and method	Mines producing [1]	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	Average value per cubic yard
Surface placers:					
Gravel mechanically handled:					
Bucketline dredges:					
1945–49 (average)	5	2,573,970	11,671	$408,492	$0.159
1950	4	2,005,000	13,549	474,215	.237
1951	4	1,729,500	10,665	373,275	.216
1952	3	458,150	2,359	82,565	.180
1953	2	904,000	3,865	135,275	.150
1954	[2] 3	904,300	4,832	169,120	.187
Dragline dredges:					
1945–49 (average)	3	349,450	1,538	53,837	.154
1950	2	296,000	1,839	64,365	.217
1951	5	137,000	938	32,830	.240
1952	6	435,000	1,769	61,915	.142
1953	4	332,000	1,476	51,660	.156
1954	2	289,000	1,308	45,780	.158
Suction dredges:					
1945–49 (average)	2	6,510	35	1,239	.190
1950	1	500	15	525	1.050
1951–54					
Nonfloating washing plants: [3]					
1945–49 (average)	4	232,310	1,900	66,500	.286
1950	9	205,100	1,684	58,940	.287
1951–52					
1953	2	16,200	46	1,610	.100
1954	4	26,100	292	10,220	.392
Gravel hydraulically handled:					
1945–49 (average)	7	26,330	157	5,495	.209
1950	10	37,100	292	10,220	.275
1951	9	17,250	93	3,255	.189
1952	5	10,100	101	3,535	.350
1953	9	181,250	425	14,875	.082
1954	7	15,800	193	6,755	.428
Small-scale hand methods: [4]					
1945–49 (average)	46	10,980	187	6,545	.596
1950	49	17,050	182	6,370	.374
1951	34	7,300	154	5,390	738
1952	15	2,900	92	3,220	1.110
1953	17	2,800	75	2,625	.937
1954	7	2,900	68	2,380	.820
Underground placers: Drift:					
1945–49 (average)	5	1,560	16	546	.346
1950–54					
Grand total, placers:					
1945–49 (average)	72	3,201,110	15,504	542,654	.170
1950	75	2,560,750	17,561	614,635	.240
1951	52	1,891,050	11,850	414,750	.219
1952	29	906,150	4,321	151,235	.167
1953	34	1,436,250	5,887	206,045	.143
1954	23	1,238,100	6,693	234.255	.189

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[2] Includes monazite dredge recovering gold as byproduct.
[3] Includes all placer operations using power excavator and washing plant, both on dry land; an outfit with movable washing plant is termed a "dry-land dredge."
[4] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, etc. "Wet" method used exclusively in Idaho.

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TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Ada	1		57	$1,995	41	$37
Blaine	3		250	8,750	554,540	501,887
Boise	3	5	199	6,965	2,411	2,182
Bonner	11		267	9,345	94,568	85,589
Bonneville		1	18	630		
Elmore	3	1	1,737	60,795	19,913	18,022
Gem	2		119	4,165	284	257
Idaho	5	9	5,018	175,630	1,065	964
Owyhee	4		17	595	6,259	5,665
Shoshone	37		2,047	71,645	14,898,699	13,484,075
Valley		1	2	70		
Washington		(1)	3	105		
Undistributed [2]	32	6	3,511	122,885	289,634	262,133
Total	101	23	13,245	463,575	15,867,414	14,360,811

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Ada							$2,032
Blaine	35	$20,650	2,418	$662,532	2,587	$558,792	1,752,611
Boise			1	274			9,421
Bonner	3	1,770	336	92,064	82	17,712	206,480
Bonneville							630
Elmore							78,817
Gem			1	274			4,696
Idaho							176,594
Owyhee	8	4,720	2	548			11,528
Shoshone	2,566	1,513,940	64,812	17,758,488	58,736	12,686,976	45,515,124
Valley							70
Washington							105
Undistributed [2]	2,216	1,307,440	1,732	474,568	123	26,568	2,193,594
Total	4,828	2,848,520	69,302	18,988,748	61,528	13,290,048	49,951,702

[1] From property not classed as a mine.
[2] Includes values and quantities which cannot be shown separately for Boundary, Butte, Camas, Custer, Jerome, Latah, and Lemhi Counties.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1954, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	770	1,060,630	249	4,701	5,349
February	510	1,253,780	330	5,190	4,364
March	720	1,477,750	434	6,478	5,500
April	670	1,269,170	353	6,025	5,465
May	1,170	1,361,910	427	5,760	5,180
June	1,695	1,342,650	422	5,562	5,067
July	1,260	1,247,540	426	5,866	4,564
August	1,650	1,408,560	467	5,928	5,088
September	1,300	1,539,490	422	5,776	5,442
October	1,340	1,353,730	431	5,887	4,922
November	1,160	1,281,554	441	5,892	5,227
December	1,000	1,270,650	426	6,237	5,360
Total	13,245	15,867,414	4,828	69,302	61,528

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TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1954, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	14	3,557	505	836	----------	2,000	----------
Dry gold-silver	7	2,208	1,906	25,566	----------	----------	----------
Dry silver	10	379,706	704	10,924,234	4,399,600	7,034,300	308,100
Total	31	385,471	3,115	10,950,636	4,399,600	7,036,300	308,100
Copper	5	162,145	1,438	11,254	4,247,500	4,000	----------
Copper-lead	1	63	1	4,336	8,300	6,000	----------
Copper-lead-zinc	1	80	----------	195	8,400	19,200	12,900
Lead	28	119,571	155	389,750	46,000	10,170,100	808,600
Lead-zinc	31	1,135,419	1,807	4,296,465	785,700	114,740,400	97,593,900
Zinc	1	16,097	6	3,988	----------	251,300	1,667,500
Total	67	1,433,375	3,407	4,705,988	5,095,900	125,191,000	100,082,900
Other "lode" material:							
Lead: Old tailings	2	110	----------	1,462	----------	35,000	7,800
Lead-zinc: Old tailings and tungsten ore [3]	4	[2] 30,317	30	134,115	160,500	1,069,900	773,400
Zinc: Old slag	1	111,689	----------	74,136	----------	5,271,800	21,883,800
Total	7	142,116	30	209,713	160,500	6,376,700	22,665,000
Total "lode" material	101	1,960,962	6,552	15,866,337	9,656,000	138,604,000	123,056,000
Gravel (placer operations)	23	([4])	6,693	1,077	----------	----------	----------
Total	124	----------	13,245	15,867,414	9,656,000	138,604,000	123,056,000

[1] Detail will not necessarily add to total, because some mines produce more than 1 class of material.
[2] Combined to avoid disclosure of individual output.
[3] Tungsten ore tonnage not included.
[4] 1,238,100 cubic yards.

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation	1,438	1,482	----------	----------	----------
Concentration, and smelting of concentrates:					
Ore	4,469	15,536,374	9,356,400	131,196,700	100,333,400
Old tailings [1]	30	134,115	160,500	1,069,900	773,400
Total	4,499	15,670,489	9,516,900	132,266,600	101,106,800
Direct smelting:					
Ore	615	118,768	139,100	1,030,600	57,600
Old tailings	----------	1,462	----------	35,000	7,800
Old slag	----------	74,136	----------	5,271,800	21,883,800
Total	615	194,366	139,100	6,337,400	21,949,200
Placer	6,693	1,077	----------	----------	----------
Grand total	13,245	15,867,414	9,656,000	138,604,000	123,056,000

[1] Includes tungsten ore (combined to avoid disclosure of individual output).

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TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties and districts, in terms of recoverable metals

County and district	Mines producing: Lode	Mines producing: Placer	Material sold or treated (short tons)	Gold, lode and placer (fine ounces)	Silver, lode and placer (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
Ada County: Boise	1		5	57	41				$2,032
Blaine County:									
Mineral Hill and Camas	2		56		327		6,000	6,000	1,766
Warm Springs	1		77,624	250	554,213	70,000	4,830,000	5,168,000	1,750,845
Boise County:									
Boise Basin	2	2	18	144	2,384		2,000		7,472
Grimes Pass		2		20	8				707
Bonner County:									
Clark Fork	3		37,942		14,683	600	576,300	142,900	107,852
Lakeview	3		12,175	264	76,590	4,800	88,100	20,500	94,258
Pend d'Oreille	5		340	3	3,295	600	7,600	600	4,370
Bonneville County: Mount Pisgah		1		18					630
Custer County:									
Alder Creek	5		671	13	2,096	27,000	125,600	25,100	30,235
Boulder	2		160	2	1,146		11,400	3,900	3,090
Seafoam	1		53	2	695	200	7,400	10,400	2,895
Yankee Fork	4	2	3,015	461	5,586				21,191
Elmore County: Middle Boise	3	1	2,222	1,737	19,913				78,817
Gem County: West View	2		174	119	284		2,000		4,696
Idaho County:									
Camp Howard (Salmon River)		(1)		2					70
Elk City	1	4	(2)	4,136	777				145,463
Ten Mile	1	1	50	672	103				23,613
Warren	1	2	1	143	83				5,080
Lemhi County:									
Mackinaw		1		1					35
McDevitt	1		310	6	263	83,600			25,110
Texas	4		512	48	8,680	1,800	213,000	2,000	39,464
Owyhee County:									
Carson or French and Snake River [3]	3		67	12	266				661
South Mountain	1		267	5	5,993	16,000	4,000		10,867
Shoshone County:									
Beaver and Coeur d'Alene [3]	3		18,202	22	33,671	40,600	1,071,500	1,486,900	350,602
Evolution	4		328,380	309	9,828,554	3,493,400	6,167,600	886,500	10,877,409
Hunter	5		301,885	547	859,418	231,400	24,652,300	39,220,000	8,478,350
Lelande	4		98,880	82	174,503	22,400	7,223,000	8,692,100	2,095,710
Placer Center	3		130,135	199	1,232,021	926,400	7,816,600	2,446,100	2,730,347
Summit	4		644	1	430	400	68,700	37,400	13,993
Yreka	14		752,124	887	2,770,102	417,400	82,624,300	64,703,000	20,968,713
Valley County: Warren		1		2					70
Washington County: Snake River		(1)		3					105
Undistributed [4]	18	6	195,050	3,078	271,289	4,319,400	3,106,600	204,600	2,075,184
Total Idaho	101	23	1,960,962	13,245	15,867,414	9,656,000	138,604,000	123,056,000	49,951,702

[1] From property not classed as a mine.
[2] Tonnage included with "Undistributed" to avoid disclosure of individual output.
[3] Combined to avoid disclosure of individual output.
[4] Includes values and quantities which cannot be shown separately for South Fork of Payette River and Summit Flat districts, Boise County; Port Hill district, Boundary County; Dome district, Butte County; Beaver Creek district, Camas County; Bayhorse and East Fork districts, Custer County; Dixie, Orogrande, and Simpson districts, Idaho County; Snake River district, Jerome County; Gold Creek and Hoodoo districts, Latah County; Blackbird, Blue Wing, Eureka, Junction, and Nicholia districts, Lemhi County.

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Production from placer mines gained 14 percent despite a drop from 34 to 23 in the number of mines reporting production. Increased output by bucketline dredges accounted for the increase. Of the total gold recovered from placers, bucketline dredges produced 72 percent; dragline dredges, 20 percent; power excavators and non-floating washing plants, 4 percent; hydraulic methods, 3 percent; and small-scale hand methods, 1 percent. Three bucketline dredges were active. Clearwater Dredging Co. continued to operate its Diesel-electric dredge, which is equipped with sixty-four 2-cubic foot buckets, on the Crooked River placers near Elk City, Idaho County, and recovered more gold than any other placer in the State. A new dredging operation by Harold E. Behrens on the Palouse River east of Harvard, Latah County, was active from April to December. Another new venture was that of Grimes Creek Dredging Co., which in May began dredging for gold and monazite in the Boise Basin district, Boise County. Dragline dredges were operated in Idaho County near Elk City by Tyee Mining Co. and Clair Johnson.

Lead.—Lead production decreased 7 percent in 1954 as the result of curtailments and mine closures in the last 2 years after a decline in metal prices. The annual total was the lowest in 8 years and second lowest since 1900. The tonnage of lead-zinc ore, which supplied the bulk of the output, was down nearly 16 percent; and, although no sizable mines were closed, the number of mines reporting production of lead-zinc and lead ores decreased from 67 in 1953 to 59 in 1954.

Lead-zinc mining trends in the State are reflected in table 12, which compares ore and recoverable-metal production since 1951 with average prices of refined metal. These statistics show the decrease in lead-zinc ore and metal output caused by declining prices, the higher recoverable-metal content of ores mined and milled due to curtailment of lower grade material, and the increase in ratio of lead production compared to zinc. Part of the comparative gain in lead output was due to mine closures and changes in milling practice after the zinc price collapsed, but some operators were able to mine ores higher in lead content than in zinc to take advantage of the price differential.

TABLE 12.—Lead-zinc ore, recoverable-metal production, and average prices, 1951–54

Year	Lead-zinc ore sold or treated (short tons)	Recoverable-metal content				Lead price (per pounds)	Zinc price (per pounds)
		Lead		Zinc			
		Pounds	Percent	Pounds	Percent		
1951	1,795,402	124,314,589	3.4	143,574,611	4.0	$0.173	$0.182
1952	1,730,972	116,899,383	3.4	135,276,262	3.9	.161	.166
1953	1,344,432	124,512,410	4.6	126,870,650	4.7	.131	.115
1954	1,135,419	114,740,400	5.1	97,593,900	4.3	.137	.108

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In the Coeur d'Alene mining region, Shoshone County, which supplied 94 percent of the lead mines in the State, the largest drop in production was from the Morning mine, where large-scale operations were terminated late in 1953 because of the decline in lead and zinc prices and increased costs of production. A salvage operation to mine ore pillars was in progress during 1954 at the property; production totaled about half that of the previous year. Block-leasing systems begun in 1953 were in effect at several operations of medium size, including Constitution, Tamarack, Sherman, Highland-Surprise, Little Pittsburgh, and Nabob. At these mines company mining was curtailed or discontinued after sections and blocks were turned over to individual or partnership lessees.

The Bunker Hill mine of Bunker Hill Mining & Concentrating Co. continued to rank first in lead production by a wide margin, and Sullivan Mining Co. Star mine was second. Other producers supplying more than 2,500 tons of recoverable lead were, in order of output, Page and Frisco, both operated by American Smelting & Refining Co.; Sunshine mine and adjoining properties worked by Sunshine Mining Co.; Morning mine of American Smelting & Refining Co.; Bunker Hill smelter slag dump; and Day Mines, Inc., Dayrock mine. The largest producers in mining areas outside Shoshone County were the Triumph operation in Blaine County and the Clayton mine in Custer County. Production in these areas declined 5 percent, and several small mines were closed. A reduction in the workweek from 6 days to 5 at most base-metal mines in the Coeur d' Alene region early in the year decreased ore output in nearly all instances; however, lead production from the Bunker Hill, Star, and Frisco mines proved to be greater than in the preceding year because higher grade ores were mined, and this offset to some extent the general decline in lead mining throughout the State. Lucky Friday output also increased over the previous year; this property remained on a 6-day week in 1954. Lead-zinc ore accounted for 83 percent of the lead produced; lead ore, 7 percent; silver ore, 5 percent; zinc old slag, 4 percent; and other sources, 1 percent.

Deep-level exploration for lead and other metals was in progress at several mines with DMEA assistance in the form of loans to cover part of the costs. DMEA contracts for lead-zinc-copper exploration involving expenditures of more than $1 million each were in effect, covering work on the Crescent and Silver Mountain properties. Other major DMEA projects were underway at the Sidney mine (lead-zinc) and the Polaris east exploration (lead-copper-antimony).

Manganese.—Oxide manganese ores produced at the Sturgill No. 1 mine in Adams County, the Magnida mine in Butte County, and the Vanza mine in Bannock County were shipped to the Government stockpile depot in Butte, Mont., during the year. The mines were operated by R. M. Caseman, Fred Foss, and the J. R. Simplot Co., respectively.

Shipments of manganese ore to the national low-grade stockpiles are not included in State production totals until the ore is removed from the stockpile for commercial use.

Mercury.—No general increase in mercury exploration and mining activity was noted in 1954 even though there was an unprecedented rise in price from a range of $187–$189 per flask in January to a record high of $325–$330 in October. The decrease in total output resulted

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mainly from operational difficulties at the Hermes mine, the only major producer in the State, by the United Mercury Mines Co. The Hermes mine is near Stibnite in Valley County.

A small quantity of scrap mercury was recovered by Brunzell & Williams from stream gravels below an old gold mill on the Trade Dollar property in Owyhee County near Silver City. This production is not included in mine output but is included in the table on secondary production in the Mercury chapter (volume I).

Nickel.—Nickel contained in cobalt concentrate produced at the Blackbird mine in Lemhi County by Calera Mining Co. is included in the State mineral-production totals.

Rare-Earth Metals.—The Baumhoff-Marshall, Inc., and Idaho-Canadian Dredging Co. bucketline dredges in Valley County near Cascade were operated throughout the year, and concentrates from the dredges were shipped by rail to the Baumhoff-Marshall, Inc., sand plant in Boise for processing. Monazite concentrate from the plant was sold to the National Stockpile and to private industry, and by-product ilmenite and zircon fractions were stockpiled at the plant. Monazite-production statistics are classified for security purposes by the Atomic Energy Commission and therefore cannot be published.

A number of reports of activity by firms interested in developing alluvial heavy-mineral deposits in Idaho were noted during the year. Of primary interest were the dredging operations planned by Porter Bros. Corp. at the Bear Valley deposits in southeastern Valley County. A contract was executed in December between GSA and Porter Bros. Corp., which provided for purchase by the Government of 1,050,000 pounds of columbium-tantalum pentoxides of 90-percent pentoxide content at $6.25 per pound. Deliveries under the contract were to be completed by December 1959. The report stated that, after preliminary concentration of material dredged from the Bear Valley deposits, the resulting euxenite concentrate would be processed to final form by the Mallinckrodt Chemical Co. The uranium oxide portion of the euxenite concentrate also would be processed by the Mallinckrodt Co. under a separate contract with the Atomic Energy Commission.

Mining engineers of the Bureau of Mines investigated heavy mineral placer deposits in Blaine County near Hailey during the year. Articles containing historical and current operating data on monazite-dredging activities in Idaho were published.[4 5]

Silver.—Increased production of silver from the Coeur d'Alene mining region, Shoshone County, advanced the output of the metal 8 percent and raised the annual yield to the highest since 1950. Four mines in the Coeur d'Alene area supplied 82 percent of all silver recovered in the State during the year; these were the Sunshine, Silver Summit, and Galena silver mines and the Bunker Hill lead-zinc mine. Increased production from the Sunshine mine, including adjoining properties operated by the Sunshine Mining Co. for affiliated companies, accounted in large part for the gain in State output. Idaho continued to be the leading producer of silver in the Nation, a rank held since 1933, and the Sunshine mine was the largest single source of silver in the United States. The major portion of Idaho's silver

[4] Engineering and Mining Journal, vol. 155, No. 3, March 1954, p. 267.
[5] Mining Engineering, vol. 6, No. 3, March 1954, p. 267.

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production was derived from silver ores, in contrast to other Western States, where most of the production came as a byproduct of base-metal ores and gold ores.

Base-metal mines besides the Bunker Hill property supplying sizable quantities of silver included Triumph mine in Blaine County and the Lucky Friday, Page, Star, and Dayrock mines in Shoshone County. Curtailments at base-metal mines, including a reduction in the workweek from 6 days to 5 at most mines in the Coeur d'Alene region early in the year, led to a drop in silver production from lead and lead-zinc ores. The workweek also was shortened at the Sunshine mine; however, this action did not take place until October 24. Development ore from the Galena silver-lead project by American Smelting & Refining Co. added large quantities of silver to the State totals. This property reached the operating stage early in 1955. During 1954 the company acquired the Zanetti Bros. mill and enlarged it to treat 350 tons of ore per day. The Galena mine was owned by Vulcan Silver-Lead Corp. and was being developed by American Smelting & Refining Co. and Day Mines, Inc., the former company being the operating concern.

Sunshine Mining Co. continued the mill reconstruction and enlargement begun late in 1953. The mill produced high-grade copper-silver-antimony concentrate, which was treated in the antimony leaching plant; a lead-silver concentrate, shipped to a lead smelter; and a low-grade silver-pyrite concentrate, which was processed by a copper smelter.

Tungsten.—Seven producers operating in Blaine, Custer, Lemhi, Shoshone, and Valley Counties produced the tungsten ore and concentrate output in Idaho during 1954. As in previous years, production of high-grade hübnerite (manganese tungstate) concentrate by the Bradley Mining Co. from the Ima mine in Lemhi County supplied a large share of the State total. Some scheelite (calcium tungstate) concentrate also was produced from the mine.

Contributing substantially to State totals were the operations of the Salmon River Scheelite Corp. at the Tungsten Jim mine in Custer County, the Bradley Mining Co. at the Springfield mine in Valley County, and the McRae Tungsten Corp. at the Snowbird mine, also in Valley County. Smaller quantities were reported produced by Williams & Douglas (Blaine County), Buckskin Mines, Inc. (Custer County), and Schmittroth & Etherton (Shoshone County). Also, Schmittroth & Etherton treated ores and concentrates from producers in Idaho, Montana, and Washington on a custom basis and sold the resulting upgraded material to the GSA.

Concentrate was produced by the Cordero Mining Co., a subsidiary of Sun Oil Co., at its Wildhorse property in Blaine County, although no shipments were made. The company began to explore the property early in the year; by December camp facilities had been constructed and mining and milling operations had begun. At Osburn, Shoshone County, Mineral Recovery & Engineering Co. completed constructing milling facilities and began custom processing of ores from within and outside the State.

Uranium.—Amateur fortune seekers and grizzled prospectors, newly organized and veteran mining companies, all vied with each other during the year in searching for a bonanza uranium strike. Although

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no major discovery was reported, many believed that it was only a matter of time. DMEA projects were active at the Surprise and Wonder properties, operated by Wilhite & Seay and Defense Metals, Inc., respectively, in Lemhi County. Counties in which other exploration and development activities were reported included Idaho, Elmore, and Shoshone.

Vanadium.—Vanadium concentrate was produced by The Anaconda Co. at Anaconda, Mont., as a byproduct from phosphate rock mined in Caribou County. (See also section on Phosphate Rock.)

Zinc.—Cutbacks in production initiated in 1953 and 1954 at lead-zinc mines because of the depressed metal market reduced output 15 percent and brought the annual total to the lowest since 1939. Lead-zinc ore supplied 79 percent of all zinc produced during the year. Ores mined averaged higher in lead content and lower in zinc compared with 1953, with the result that the drop in zinc production was much greater than for lead. Production records showed that the decline in zinc yield was general at major mines. A minor quantity of zinc concentrate was stored pending improvement in prices; however, in most instances all concentrate was marked as produced.

The Bunker Hill smelter recovered large tonnages of lead and zinc by smelting material from an old slag dump and increased its output over the previous year's total. Metals recovered from the old slag were credited to current mine-production statistics. The largest producers, in order of output, were Star mine, Sullivan Mining Co.; Bunker Hill mine, Bunker Hill & Sullivan Mining & Concentrating Co.; Frisco, American Smelting & Refining Co.; Sidney, Sidney Mining Co.; and Triumph, Triumph Mining Co. All except the Triumph (a Blaine County operation) were in Shoshone County. The mines each produced over 2,500 tons of recoverable metal and accounted for 88 percent of all zinc mined in the State. Shoshone County produced 95 percent of the zinc; Blaine County, 4 percent; and Boundary, Bonner, and Custer Counties the balance.

The unsatisfactory market situation affected refined-metal output as well as mine production. Declining sales caused a reduction in operations in February at the Sullivan electrolytic zinc plant at Kellogg; the plant was operated at less than capacity for 9 months until improving conditions enabled the resumption of full-scale operations. For the year production averaged 82 percent of capacity.

NONMETALS[6]

Barite.—Production was resumed at the J. R. Simplot Co. Sun Valley open-pit mine on Deer Creek in Blaine County to augment stocks at the Pocatello grinding plant; shipments of ground barite from the plant declined about 33 percent below the 1953 level. The ground product, used for rotary-drilling mud, was shipped to users in Oklahoma, Texas, California, and Colorado.

Cement.—Idaho Portland Cement Co., the only cement producer in Idaho, reported a production increase of about 30 percent over 1953. The plant at Inkom, Bannock County, processed raw materials quarried locally. Out-of-State shipments were made to Montana,

[6] Norman S. Petersen, commodity-industry analyst, Region I, Albany, Oreg., assisted in preparing this section.

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Oregon, Nevada, and Wyoming. According to an article, concrete pilings used in offshore oil-well drilling in Louisiana were made by a machine developed by the Idaho Concrete Pipe Co., Nampa, Idaho. [7] The subject of natural pozzolan was covered in an informative article.[8]

Clays.—The output of clay increased 20 percent over 1953. Fire clay was produced by the Troy Firebrick Co., Latah County. Companies producing miscellaneous clay included: Idaho Falls Brick & Tile Co., Inc., Bonneville County; Pullman Brick Co., Ada County; Burley Brick & Sand Co., Inc., Cassia County; and Jensen Brick Co., Payette County. The bulk of the output was used to make heavy clay products, including building brick, drain tile, and sewer pipe. Most of the fire clay went into firebrick.

Fluorspar.—There was no fluorspar production in Idaho during 1954. J. R. Simplot Co. surrendered its lease and option on the Chamac mine, Meyers Cove, Lemhi County (operated under name of Fluorspar Mines, Inc.), to A. E. Chambers, owner. The Keystone mine near Challis in Custer County, owned by the same individual, also was idle.

Prospecting, exploration, and investigation of fluorspar deposits continued. Publications described deposits in Custer [9] and Lemhi [10 11] Counties. Health hazards of fluorine and its compounds were described in a Bureau of Mines report.[12]

Garnet.—Production of abrasive garnet concentrate by Idaho Garnet Abrasive Co. increased about 30 percent above 1953. Garnet-bearing sand from the Emerald Creek area of Benewah County was processed at the company Fernwood plant. The product was used principally for sandblasting.

Gypsum.—There was a substantial increase in the quantity of gypsum produced by the one operator in the State. Melvin Taylor & Sons operated the Northwest Gypsum Co. Rock Creek mine on the Snake River, 20 miles northwest of Weiser, Washington County. The output of the deposit was used for agricultural purposes.

Mica.—Hand-cobbed mica and a small quantity of scrap mica from the Muscovite mine were shipped to the GSA depot, Custer, S. Dak., by the Idaho Beryllium & Mica Corp. Underground development and exploration were continued at the mine, near Deary, Latah County. The Rocky Mountain Cooperative Prospecting Co. reportedly explored and was planning to develop a ruby-mica deposit near Kooskia, Idaho County.

Phosphate Rock.—Production of phosphate rock exceeded the million-long-ton mark for the second consecutive year and surpassed the 1953 total by about 9 percent. In contrast, the volume of rock sold or used declined about 18 percent. A temporary curtailment of available electrical power for producing elemental phosphorus and a phosphate-fertilizer plant breakdown contributed to the decreased consumption of phosphate rock.

[7] Rock Products, vol. 57, No. 6, June 1954, p. 179.
[8] Bauer, W. G., Technical Consideration of Natural Pozzolan Production: Pit and Quarry, No. 4, April 1954, pp. 41-46 and No. 5, May 1954, pp. 83-86.
[9] Anderson, A. L. Preliminary Report, Fluorspar Mineralization Near Challis, Custer County, Idaho: Idaho Bureau of Mines and Geol. Pamph. 101, August 1954, 13 pp.
[10] Cox, D. C., Fluorspar Deposits Near Meyers Cove, Lemhi County, Idaho: Geol. Survey Bull. 1015-A, 1954, pp. 1-21.
[11] Anderson, A. L., Fluorspar Deposits Near Meyers Cove, Lemhi County, Idaho: State of Idaho Pamph. 98, August 1954.
[12] Davenport, S. J., and Morgis, G. G., Review of Literature on Health Hazards of Fluorine and Its Compounds on the Mining and Allied Industries: Bureau of Mines Inf. Circ. 7687, June 1954.

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Output of high-grade phosphate rock and of phosphatic shale from the open-pit Gay mine, the principal producer in the State, was slightly lower than in 1953. The mine, near Fort Hall in Bingham County, was owned and operated by the J. R. Simplot Co. High-grade rock was shipped to the company fertilizer plant in Pocatello for conversion to ordinary superphosphate and triple superphosphate. The phosphatic shale was used in manufacturing elemental phosphorus at the Pocatello plant of Westvaco Chemical Division, Food Machinery & Chemical Corp.

Monsanto Chemical Co. almost doubled the output of its Ballard open-pit mine in Caribou County. Rock, strip-mined under contract by Morrison-Knudsen Co., Inc., was shipped to the company-owned elemental phosphorus plant at Soda Springs. Construction of a second electric furnace was completed in October. It was estimated that the productive capacity of elemental phosphorus would be doubled as a result of this new furnace installation.

The output of phosphate rock by The Anaconda Co. from the underground Conda No. 3 mine and from the strip operation, both in Caribou County, was reduced substantially below the 1953 level. This decrease was brought about by a strike, which started late in August and stopped production for about 2 months, and by limited production during the remainder of the year because of lessened demand at the metallurgical plant at Anaconda, Mont., which was undergoing alterations. Installation of new classifiers and other modifications at the Conda beneficiation plant improved its performance.

Production of phosphate rock by the San Francisco Chemical Co. from its Waterloo open-pit mine in Bear Lake County was about 44 percent greater than 1953. Exploratory work at the underground Cumberland mine was suspended temporarily about midyear.

The Jefferson Lake Sulphur Co., New Orleans, La., announced plans to construct a $3 million plant in southeastern Idaho, probably in Bear Lake County, to manufacture triple superphosphate.[13] The company, a sulfur producer 25 years, was to utilize the sulfuric acid wet process and include a unit to convert sulfur to sulfuric acid.

Reports on Idaho phosphate-rock formations and the fertilizer industry in the Pacific Northwest were published.[14 15 16]

Pumice.—The quantity of pumice reported sold and used by the 4 producers in Blaine and Bonneville Counties was about 10 percent greater than in 1953. Use in concrete aggregate still predominated; relatively small quantities were employed for acoustic plaster and insulation.

The Katie Lee and Albino quarries, owned by Pumice, Inc., and Clark Concrete Construction Corp., respectively, continued to supply most of the production. Both operations were near Idaho Falls in Bonneville County. Pumice for use in lightweight aggregate also was produced by Idaho Falls Brick & Tile Co., Bonneville County, and Sun-ite Corp., Blaine County.

[13] Engineering and Mining Journal, vol. 155, No. 12, December 1954, p. 130.
[14] Smart, R. A., Waring, R. G., Cheney, T. M., and Sheldon, R. P., Stratigraphic Sections of the Phosphoria Formation in Idaho: Geol. Survey Circ. 327, 1954, 22 pp.
[15] Raw Materials Survey, Portland, Oreg., The Fertilizer Industry in the Pacific Northwest: Circ. 6, 2d edition.
[16] Kummel, Bernhard, Triassic Stratigraphy of Southeastern Idaho and Adjacent Areas: Geol. Survey Prof. Paper 254-H, 1954, pp. 165-194.

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TABLE 13.—Sand and gravel sold or used by producers in Idaho, 1953–54, by classes of operations and uses

	1953			1954			Percent of change in—	
	Short tons	Value		Short tons	Value		Tonnage	Average value
		Total	Average		Total	Average		
COMMERCIAL OPERATIONS								
Sand:								
Building	179,710	$226,410	$1.26	222,874	$267,017	$1.20	+24	−5
Road material	32,825	42,640	1.30	43,946	38,023	.87	+34	−33
Other	45,830	17,070	.37	1,340	808	.60	−97	+62
Total commercial sand	258,365	286,120	1.11	268,160	305,848	1.14	+4	+3
Gravel:								
Building	282,170	328,215	1.16	328,821	419,731	1.28	+17	+10
Road material	294,210	315,680	1.07	1,871,061	1,506,075	.80	+536	−25
Railroad ballast	33,215	2,945	.09	35,867	6,527	.18	+8	+100
Other	6,925	6,845	.99	220,364	145,780	.66	+3,082	−33
Total commercial gravel	616,520	653,685	1.06	2,456,113	2,078,113	.85	+298	−20
Total commercial sand and gravel	874,885	939,805	1.07	2,724,273	2,383,961	.88	+211	−18
GOVERNMENT-AND-CONTRACTOR OPERATIONS								
Sand:								
Building	70,385	80,945	1.15	1,572	2,410	1.53	−98	+33
Road material	132,885	66,430	.50	289,156	65,562	.23	+118	−54
Total Government-and-contractor sand	203,270	147,375	.73	290,728	67,972	.23	+43	−68
Gravel:								
Building	176,865	201,945	1.14	23,009	25,897	1.13	−87	-------
Road material	2,521,160	1,552,315	.62	3,679,690	2,091,089	.57	+46	−8
Total Government-and contractor gravel	2,698,025	1,754,260	.65	3,702,699	2,116,986	.57	+37	−12
Total Government-and-contractor sand and gravel	2,901,295	1,901,635	.66	3,993,427	2,184,958	.55	+38	−17
ALL OPERATIONS								
Sand:								
Building	250,095	307,355	1.23	224,446	269,427	1.20	−10	−2
Road material	165,710	109,070	.66	333,102	103,585	.31	+101	−53
Other	45,830	17,070	.37	1,340	808	.60	−97	+62
Total sand	461,635	433,495	.94	558,888	373,820	.67	+21	−29
Gravel:								
Building	459,035	530,160	1.15	351,830	445,628	1.27	−23	+10
Road material	2,815,370	1,867,995	.66	5,550,751	3,597,164	.65	+97	-------
Railroad ballast	33,215	2,945	.09	35,867	6,527	.18	+8	+100
Other	6,925	6,845	.99	220,364	145,780	.66	+3,082	−33
Total gravel	3,314,545	2,407,945	.73	6,158,812	4,195,099	.68	+86	−7
Total sand and gravel	3,776,180	2,841,440	.75	6,717,700	4,568,919	.68	+78	−9

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A comprehensive review of lightweight-aggregate materials was published.[17]

Sand and Gravel.—Gross output of 6.7 million tons of sand and gravel valued at $4.6 million was distributed as follows: Commercial, 2.7 million tons ($2.4 million) and Government-and-contractor, 4 million tons ($2.2 million). Comparable figures for the 1953 distribution were commercial, 0.9 million tons ($0.9 million) and Government-and-contractor 2.9 million tons ($1.9 million). Thirty-six of the State's 44 counties reported production. The principal producers were Cassia, Oneida, Canyon, Bonneville, Twin Falls, and Ada counties.

The apparent increase in commercial output was due entirely to better coverage of the industry for the 1954 canvass. Knowledge of active sand and gravel operations was expanded as a result of information collected during the 1953 canvass, and response from these producers improved significantly. Increased activities of Federal, State, and county agencies accounted for the advance in Government-and-contractor production. Over two-thirds of the commercial output was used for road construction, with most of the remainder going into building materials and other miscellaneous uses. An informative article was published covering sand and gravel.[18]

Silica.—Washed and ground silica sand for use as an abrasive and as plaster aggregate was produced by Gem Silica Co., Emmett, Gem County. Magnetic separators were installed, and a test shipment of glass-sand grade was made to Northwest Glass Co., Seattle.

Stone.—An increase of about 104 percent in the output of stone was accompanied by a rise of only 33 percent in value. A total production of 2.3 million tons valued at $2.8 million was divided between commercial, 1.5 million tons ($2 million), and Government-and-contractor, 0.8 million tons ($0.8 million). Of the 19 counties reporting production, Idaho, Latah, Lewis, and Bannock had the largest output. The principal use of the crushed stone was for road construction; other uses included railroad ballast and riprap.

There was a substantial increase in the quantity of limestone produced by the Lewiston Lime Co., Inc., at its quarry and plant on Mission Creek near Lapwai, Lewis County. This high-purity limestone was used primarily for chemical and metallurgical purposes.

Quartzite was produced from a deposit in Power County by the Westvaco Chemical Division, Food Machinery & Chemical Corp. Output was used as a furnace flux in the electric furnaces of the company phosphorus plant near Pocatello. Pacific Northwest Alloys, Inc., crushed vein quartz taken from a deposit in Bonner County a few miles east of Newport, Wash. The output was used at the company ferroalloy plant at Spokane, Wash.

Sulfuric Acid.—Early in May production of byproduct sulfuric acid was begun at the Sullivan Mining Co. $3 million acid plant at Kellogg, Shoshone County. When in full production, the plant will have an annual capacity of 80,000 to 90,000 tons of sulfuric acid—about 10 percent of the byproduct sulfuric acid recovered from the Nation's base-metal-ore smelters.

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[17] Chesterman, Chas. W., Lightweight Aggregates of the West: Min. Cong. Jour., vol. 40, No. 12 December 1954, pp. 67–69.
[18] Walker, Stanton, Merchandisable Sand and Gravel: Pit and Quarry, No. 5, May 1954, pp. 134–138, 150.

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MINERAL FUELS

Peat.—A small quantity of peat was reported produced in Bannock County in 1954.

REVIEW BY COUNTIES AND DISTRICTS

Mineral output was reported from 42 of Idaho's 44 counties in 1954. Only Adams and Teton Counties had no production. Shoshone County, with its extensive productive silver-lead-zinc deposits, continued as the center of the State's mining activity; the value of minerals produced in the county was nearly double the combined values for all other counties in the State.

Table 14 shows mineral production by counties for 1953 and 1954.

Counties for which only output of the essential but commonplace commodities (sand and gravel and stone) was reported are included in table 14 but are not covered in the following narrative material.

Ada.—Ada County was the principal sand- and gravel-producing county in the State. Sand and gravel for paving and building purposes, valued at $397,000 was produced by Chaussee-Swan Gravel Co., Nelson Gravel Co., and Quinn Robbins Co., Inc., all of Boise, and by county road crews. Crushed traprock was prepared by the highway department for roadwork. Structural clay products were manufactured from clay mined by the Pullman Brick Co., Boise.

Boise District.—Joseph F. Kallas, Sr., recovered 57 ounces of gold and 41 ounces of silver by amalgamation from 5 tons of gold ore.

Bannock.—Several shipments of oxide manganese ore were made to the National Strategic Stockpile depot at Butte, Mont., by J. R. Simplot Co. from its underground Vanza mine near Lava Hot Springs.

Idaho Portland Cement Co. continued to be the only cement producer in the State and the major mineral industry in the county. Limestone quarried near the plant at Inkom was used in the manufacturing process. A small quantity of paving gravel was produced by the city of Pocatello and by contractors for the State. Shale and sandstone for paving were mined by county and State highway crews. The Union Pacific Railroad Co. quarried traprock near Inkom for railroad ballast. Westvaco Chemical Division, Food Machinery & Chemical Corp., operated an elemental phosphorus plant near Pocatello, and the J. R. Simplot Co. manufactured phosphate fertilizers at its plant west of Pocatello.

Bear Lake.—Except for a small quantity of sand and gravel, phosphate rock was the only mineral commodity produced in the county. San Francisco Chemical Co. increased production from its Waterloo open-pit mine near Montpelier by about 44 percent. The output of the Waterloo pit was shipped to various processors for conversion to elemental phosphorus and superphosphates. Underground exploration at the nearby Cumberland mine was suspended temporarily about midyear. Plans were announced by the Jefferson Lake Sulphur Co. of New Orleans, La., for construction of a $3 million plant to manufacture triple superphosphate.[19] The company intended to install a unit to convert sulfur to sulfuric acid.

[19] Engineering and Mining Journal, vol. 155, No. 12, December 1954, p. 130.

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TABLE 14.—Value of mineral production in Idaho, 1953–54, by counties

County	1953	1954	Minerals produced in 1954 in order of value
Ada	$446,430	$421,088	Sand and gravel, stone, clays, gold, silver.
Adams	(1)		
Bannock	(1)	(1)	Cement, sand and gravel, stone.
Bear Lake	(1)	(1)	Phosphate rock, sand and gravel.
Benewah	(1)	(1)	Garnet, stone, gold.
Bingham	(1)	(1)	Phosphate rock, sand and gravel, stone.
Blaine	2,175,177	2,009,497	Lead, zinc, silver, sand and gravel, barite, copper, pumice, gold, tungsten.
Boise	14,267	29,821	Sand and gravel, gold, silver, lead.
Bonner	334,886	409,557	Quartz, sand and gravel, lead, silver, zinc, gold, copper.
Bonneville	2,000,451	488,843	Sand and gravel, pumice, stone, clays, gold.
Boundary	59,737	134,338	Stone, lead, sand and gravel, silver, zinc.
Butte	(1)	2,963	Sand and gravel, copper, lead, silver.
Camas	53,193	(1)	Lead, silver, gold.
Canyon	218,735	251,061	Sand and gravel, stone.
Caribou	(1)	(1)	Phosphate rock, vanadium, sand and gravel, stone.
Cassia	282,221	331,527	Sand and gravel, clays.
Clark	9,694	(1)	Sand and gravel.
Clearwater	245,276	(1)	Stone.
Custer	663,907	714,098	Lead, silver, sand and gravel, zinc, copper, gold tungsten.
Elmore	132,482	128,138	Gold, sand and gravel, silver.
Franklin	28,670	26,046	Sand and gravel.
Fremont	2,495	48,851	Sand and gravel, stone.
Gem	62,878	166,968	Sand and gravel, sandstone (ground sand), gold, lead, silver.
Gooding	1,712	69,833	Sand and gravel.
Idaho	238,638	960,698	Stone, gold, sand and gravel, silver.
Jefferson	2,000	(1)	Sand and gravel, stone.
Jerome		99,566	Sand and gravel, stone, gold.
Kootenai	103,185	63,317	Sand and gravel.
Latah	341,284	573,046	Stone, mica, gold, clay, beryllium, silver.
Lemhi	3,579,730	4,931,452	Cobalt, tungsten, copper, sand and gravel, silver, lead, gold, nickel, zinc.
Lewis	(1)	(1)	Stone, sand and gravel.
Lincoln	108,195	121,268	Sand and gravel.
Madison		(1)	Stone.
Minidoka	(1)	(1)	Sand and gravel.
Nez Perce	(1)	137,436	Do.
Oneida	14,975	(1)	Do.
Owyhee	79,466	155,075	Sand and gravel, silver, copper, gold, lead.
Payette	(1)	(1)	Clays, sand and gravel.
Power		181,475	Sand and gravel, quartzite.
Shoshone	47,875,687	45,948,388	Lead, silver, zinc, copper, stone, sand and gravel, gold, tungsten.
Teton	37,395		
Twin Falls	565,300	400,069	Sand and gravel, stone.
Valley	343,822	395,291	Mercury, tungsten, sand and gravel, gold.
Washington	(1)	(1)	Gold, gypsum.
Undistributed	6,978,112	10,493,153	
Total	67,000,000	69,693,000	

[1] Included with "Undistributed" to avoid disclosure of individual company operations.

Benewah.—Production of abrasive garnet concentrate from Emerald Creek by Idaho Garnet Abrasive Co. was the principal mineral-industry activity of Benewah County. As a result of the output from this operation, Idaho ranked among the principal garnet-producing States.

Bingham.—The Gay-mine open-pit operation of J. R. Simplot Co. continued to be the largest phosphate-rock producer in the State and the major mineral industry of Bingham County. High-grade phosphate rock and phosphatic shale were mined at the property 18 miles east of Fort Hall on the Fort Hall Indian Reservation. Alterations were completed at the company Pocatello plant, which permitted production of treblesuperphosphate as well as ordinary superphosphate. These products were made from the high-grade rock. The phosphatic shale was shipped to the Pocatello plant of Westvaco Chemical Division, Food Machinery & Chemical Corp., for conver-

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sion into elemental phosphorus. Building sand and gravel and paving gravel were mined. The county produced pit-run gravel for its own use, and State highway crews quarried traprock for riprap.

Blaine.—Williams & Douglas shipped tungsten ore to the Schmittroth and Etherton Big It mill in Shoshone County for treatment and sale to the GSA.

Gravel was mined by contractors for the Bureau of Public Roads and by the county highway department. Barite production was resumed by the J. R. Simplot Co. from its Sun Valley open-pit mine. Output of the mine was ground at the company-owned plant in Pocatello. Crushed pumice for use in lightweight aggregate was prepared by the Sun-ite Corp. from rock quarried at its Magic Reservoir site near Hailey.

Mineral Hill and Camas District.—Concentrate containing recoverable lead, zinc, and silver were produced by Silver Star-Queens Mines, Inc., from the Queen of the Hills mine. Ore containing recoverable lead, zinc, and silver also was taken from Memorial No. 1 & 2 mine 1 mile southeast of Hailey, by C. E. Oswald.

Warm Springs District.—Output of lead-zinc ore from the Triumph mine by Triumph Mining Co. declined to 77,624 tons from 93,132 in 1953. The company produced 3,686 tons of lead concentrate and 4,960 tons of zinc concentrate. The recoverable metal content of the lead concentrate was 156 ounces of gold, 464,813 ounces of silver, 70,300 pounds of copper, 4,734,500 pounds of lead, and 179,700 pounds of zinc. Zinc concentrate yielded 94 ounces of gold, 89,400 ounces of silver, 95,500 pounds of lead, and 4,988,300 pounds of zinc. The company began work on a $143,354 DMEA exploration project.

Boise.—Road gravel was produced under contract for the State.

Boise Basin District.—The Comeback mine (gold-silver ore) and the Golden Age mine (lead ore) were operated by Comeback Mining Co. and Dean Hawkins, lessee, respectively. Grimes Creek Dredging Co. produced byproduct gold and some silver while working stream gravels with a bucketline dredge to recover monazite. Monazite-bearing dredge concentrate was shipped to the Baumhoff-Marshall, Inc., sand plant at Boise for treatment. James H. Manning recovered a small quantity of gold and silver at the Slave Acres placer.

Grimes Pass District.—Small quantities of placer gold and silver were recovered by Louis F. Truger and R. Adair.

Summit Flat District.—Gold and silver were recovered by amalgamation at the Jessie property by L. M. Sloper.

Bonner.—Output of crushed quartz by Pacific Northwest Alloys, Inc., from a deposit a few miles east of Newport, Wash., declined about 32 percent compared with 1953. The crushed quartz was used at the company ferroalloy plant in Spokane, Wash. Gravel for railroad ballast was produced by the Spokane International Railroad Co. from a pit near Clagstone. Materne Bros., Spokane, Wash., mined gravel for road construction and Clifton & Applegate Co. prepared gravel for State highway work.

Clark Fork District.—Whitedelf Mining & Developing Co. produced 118 tons of concentrate from 2,364 tons of lead ore. Silver, copper, lead, and zinc were recovered. Lead ore also was produced by the Lawrence Consolidated Mining Co. at the Lawrence mine. Lead-

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zinc ore was produced and lead and zinc concentrates were shipped from the Hope mine by Hope Silver-Lead Mines, Inc.

Lakeview District.—Development was continued at the Conjecture mine by Funnell & Majer Mining Co. during the year; 196 tons of concentrate containing 30 ounces of gold, 17,050 ounces of silver, 4,000 pounds of copper, 22,100 pounds of lead, and 14,000 pounds of zinc was produced from 4,242 tons of crude ore. At the Weber mine 7,745 tons of crude ore was shipped by Austin-Meyer Corp. and 108 tons by New Rainbow Mining Co. The Austin-Meyer operation was limited to the area above the mine's No. 3 level. Idaho Lakeview Mines Co. continued operations at the Keep Cool mine; 14 tons of lead-zinc concentrate was produced from 80 tons of crude ore during the year.

Pend Oreille District.—Small quantities of silver ore were shipped to the Bunker Hill smelter by Marvin Hines from the Brown Bear mine, by Moyle & McConnaughey from the Katherine mine, and by V. Anderson from the Peake Lode (old Talache) mine. At the Peake Lode a quantity of dump ore was milled and 6 tons of concentrate produced. Lead ore was shipped from the Little Senator mine by Alfred Hunter and Ray Cork and from the Silver Fox property by A. & J. Mining Co.

Bonneville.—Sand and gravel output by four producing companies was valued at $233,700. The decline from the 1953 total of $500,000 was due to completion of major construction work at the Bureau of Reclamation Palisades project. Municipal and county crews mined paving gravel. Bonneville County continued to be the principal pumice-producing county in Idaho. Output from the Katie Lee quarry east of Ammon, operated by Pumice, Inc., was used for lightweight aggregate, insulation, and acoustic plaster. Facilities were completed at the plant to process minus-325-mesh pumice for use as a natural pozzolan.[20] This and other company products are marketed under the trade name "Volcolite." Pumice for use in concrete blocks, lightweight aggregate, and acoustic plaster was produced by the Clark Concrete Construction Corp. at its Albino quarry 8 miles east of Idaho Falls. The Rock Top quarry near Idaho Falls was operated by the Idaho Falls Brick & Tile Co., Inc. The company also manufactured heavy clay products from locally mined clay. Riprap was used by the Bureau of Reclamation at the Palisades project and by State highway crews.

Mount Pisgah District.—Wayne Dick recovered 18 ounces of gold by hydraulicking at the Stapleman claim.

Boundary.—Gravel and traprock for the Great Northern Railway Co. were mined by Morrison-Knudsen Co. from deposits near Bonners Ferry. The county mined sand and gravel for road maintenance, and the railroad company mined basalt near Crossport for use as ballast. County road crews produced granite for road building.

Port Hill District.—Lead concentrate was produced by Northwood Mining & Leasing Co. from the Idaho-Continental mine; the company also shipped a small quantity of lead ore direct to the Bunker Hill smelter.

[20] Utley, H. F., Idaho Firm Adds Processing Plant to Produce Natural Pozzolan: Pit and Quarry, vol. 86, 1954, pp. 75–76.

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Butte.—The Magnida mine, operated by Fred Foss, was the largest of the three manganese producers in the State. Ore was shipped from the open-pit operation to the Butte, Mont., Government low-grade manganese-ore stockpile.

Dome District.—Ralph M. Taylor produced a small quantity of copper ore from the Copper Mountain mine. Lead ore produced in 1953 was shipped by Roy D. and Dean Wortley.

Camas.—*Beaver Creek District.*—A small quantity of lead ore was produced during development work from the Princess Blue Ribbon mine by J. R. Davies & Son.

Canyon.—Sand and gravel valued at $240,000 was produced by the 6 active companies and the county. Contractors supplied paving gravel to the State and sand and gravel to the Bureau of Reclamation for its Central Snake River district. A small quantity of basalt was mined for use at the same project.

Caribou.—Phosphate-rock operations of Monsanto Chemical Co. and The Anaconda Co., both near Soda Springs, were the principal mining activities in the county. Production from the Ballard open pit of Monsanto Chemical Co. was almost twice as great as 1953. Morrison-Knudsen Co., Inc., under contract, did the stripping, loading, and hauling of the rock to the elemental phosphorus plant at Soda Springs. Ferrophosphorus was produced as a byproduct at the plant. Silica needed to adjust slag basicity was obtained from a local quartzite deposit. Monsanto placed its second electric furnace for producing elemental phosphorus in operation about the middle of October. A record of development of western phosphate operations appeared in an article.[21] There was a substantial reduction in the quantity of phosphate rock produced by The Anaconda Co. at its Conda operations. A strike and a temporary curtailment at the fertilizer plant figured in this decline. Phosphate rock from the underground Conda No. 3 mine and from the open pit was shipped by rail to the company metallurgical plant at Anaconda, where triple superphosphate and phosphoric acid were manufactured and vanadium was recovered as a byproduct. The State mined a small quantity of sand and gravel and scoria for road maintenance.

Cassia.—Cassia County ranked second in the State in value of sand and gravel output ($326,000). Gravel for road construction was produced by the Long Sand & Gravel Co., highway district crews, and contractors for the State highway department. Clay mined at the Burley pit of the Burley Brick & Sand Co., Inc., was made into structural clay products.

Clearwater.—The J. F. Konen Construction Co., Lewiston, operated a portable plant near Orofino to produce crushed rock for road construction.

Custer.—Cordero Mining Co., a subsidiary of Sun Oil Co., began to explore a tungsten occurrence discovered by prospectors in the spring of 1953. After acquisition of the property (near Wild Horse Creek on the north slope of Hyndman Peak) the company began to construct camp and milling facilities. Mining operations were begun midyear and by fall milling of the scheelite ore was started. All output of concentrate during the year was stockpiled. A small

[21] Emigh, G. Donald, Development of Monsanto's Western Phosphate Operations: Min. Eng., No. 6, November 1954, pp. 1077-1079.

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quantity of tungsten ore was produced by Buckskin Mines, Inc.; bulk concentrate was shipped to the Schmittroth & Etherton Big It custom mill for treatment and sale to the GSA. Salmon River Scheelite Corp. was organized to operate the Tungsten Jim and Scheelite Nellie deposits near Clayton. After necessary road construction ore was shipped to the Bay Horse Mines, Inc., mill at Challis for preliminary treatment and subsequently shipped to the Schmittroth & Etherton mill and the Mineral Recovery & Engineering Co. custom mill for upgrading and sale to GSA.

Gravel for the Bureau of Public Roads was produced by the Aslett Construction Co. Fluorspar deposits near Challis were investigated by the Idaho Bureau of Mines and Geology.

Alder Creek District.—Taylor & Pritchett produced 282 tons of crude ore yielding 53 tons of lead concentrate and 12 tons of zinc concentrate from the Champion mine. Two operators (MacKay Exploration Co. and Anderson, Uhrig, Shirts & Shirts) shipped copper ore from the Empire mine to the Garfield, Utah, smelter. Myron and Curt Fullmer, lessees, operated the White Knob Mining Co. Homestake mine and shipped lead ore to the Midvale, Utah, smelter. A small quantity of lead ore also was produced by Ira C. Lambert and V. A. Anderson from the Horse Shoe mine. Copper-lead-zinc ore was shipped to the East Helena smelter from the Mackinac and Comanche groups by Harold Lambert, Paul Uresti, and Bolen Uresti.

Bayhorse District.—Operations at the Clayton mine and mill of Clayton Silver Mines continued throughout the year although, as in 1953, zinc concentrate produced from the company mill was stockpiled because of the low price for zinc. The company produced 30,448 tons of crude ore, which yielded 1,936 tons of lead concentrate and 897 tons of zinc concentrate. The total of zinc concentrate accumulated in the stockpile amounted to 1,391 tons. Recoverable content of the lead concentrate was gold, 36 ounces; silver, 130,509 ounces; copper, 19,800 pounds; lead, 2,374,500 pounds; and zinc, 99,500 pounds. Mine development, according to the company annual report, consisted of drifting, 849 feet; raising, 323 feet; crosscutting, 45 feet; and sinking, 49 feet. Deepening of a shaft to serve the 550 level was completed; drifting to the south 250 feet and to the north 610 feet was accomplished on the 550 level; and a drainage, ventilation, and escapeway raise was run from the 400 level to the 200. Mill operation was at capacity throughout the year; almost all of the tonnage treated was derived from the large north stope on the 400 level. Ore reserves in the mine at the end of the year were estimated by the company to be 68,805 tons. Bay Horse Mines, Inc., operated the Ramshorn mine and shipped crude ore and concentrates. A quantity of lead ore was shipped from the Red Bird mine by Buchman, Breckon, & Norden.

Boulder District.—Idaho Custer Mines continued exploratory work under a $97,737 DMEA contract and produced a small quantity of lead-zinc concentrate at the old Livingston mine. A block-leasing system of operations in the upper levels of the mine was initiated in the latter part of the year. Lead ore was shipped to the Midvale, Utah, smelter by Frank L. Fisher from the Little Livingston property.

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East Fork District.—Highland Surprise Consolidated Mining Co. began extensive exploration in the district in the latter part of the year after acquisition of the Deer Trail, Confidence, and F. D. R. groups of claims. The company also staked a number of claims and a mill site adjoining the property. The F. D. R. group was purchased in August, and the Deer Trail property was acquired from Deer Trail Mines on October 1 under a 10-year lease and purchase option. According to the Highland-Surprise annual report, a limited amount of bulldozing and diamond drilling indicated a sizable body of lead-zinc ore, and an extensive program was slated for the spring of 1955. Before acquisition of the Deer Trail property by the company, a small quantity of lead-zinc concentrate was produced by Deer Trail Mines; similarly, at the F. D. R. property, E. W. Fox and R. Neice shipped a small quantity of lead ore.

Seafoam District.—At the Mountain King property Fred and Earl Shirts mined 53 tons of lead-zinc ore from which were produced 7 tons of lead concentrate yielding 1 ounce of gold, 579 ounces of silver, 100 pounds of copper, and 6,900 pounds of lead and 10 tons of zinc concentrate yielding 1 ounce of gold, 116 ounces of silver, 100 pounds of copper, 500 pounds of lead, and 10,400 pounds of zinc.

Yankee Fork District.—Lucky Custer Mining Corp. operated the Lucky Boy property on Custer Mountain 12 miles east of Sunbeam and recovered a quantity of gold and silver by amalgamation. Gold-silver ore also was shipped to the Midvale, Utah, smelter. Other lode-mining operations in the district included: C. C. Pierce at the Fairplay mine (gold-silver ore); Nels D. Johnson at the Lucky Day property (gold ore amalgamated); and C. H. Heisen at the McFadden property (gold-silver ore). Small quantities of gold and silver were recovered at placer operations; W. V. Bonnicsen worked the Ace-in-the-Hole property, and A. W. McGowan worked a placer deposit in Alder Gulch near Challis.

Elmore.—Building sand was recovered from the Dodge Sand & Gravel pit. Contractors produced paving gravel for the State, and highway-district crews mined gravel for their own use.

Middle Boise District.—Operations at the Boise-Rochester group, discontinued by Talache Mines, Inc., in October 1953, were continued by lessees during 1954. A total of 2,028 tons of crude ore was milled at the Talache mill, yielding 31 tons of concentrate containing 539 ounces of gold and 18,716 ounces of silver. E. T. Seaton treated a quantity of gold ore by amalgamation (recovering 21 ounces of gold and 11 ounces of silver) at the Golden Stringer property and also shipped 2 tons of gold ore to the Midvale, Utah, smelter. Little Queen Mines, Inc., shipped 150 tons of gold ore to the Talache mill, which recovered 61 ounces of gold, and 244 ounces of silver by amalgamation. A quantity of gold and silver recovered by hydraulicking before 1953 from the King and Queen placer deposit was sold by George I. Fenton.

Fremont.—Peter Kiewit & Sons and L. T. Johnson Co. provided gravel for State highway-construction projects. A small quantity of building sand and gravel was produced for the Bureau of Public Roads. Building gravel also was supplied by a contractor.

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Gem.—Building and paving sand and gravel were produced by the City Transfer Co., Emmett. The Duffy Reed Construction Co. supplied road gravel to the state highway department. Silica sand from the Emmett deposit of the Gem Silica Co. was marketed for use as an abrasive and as plaster aggregate.

West View District.—Gem State Consolidated Mines, Inc., produced 149 tons of crude ore from the Gem State mine and Dewey group; a quantity of gold and silver was recovered by amalgamation, and 19 tons of gold concentrate was produced. Joe Burkhart milled gold ore containing a small quantity of recoverable gold and silver at the Silver Rock mine.

Gooding.—Sand and gravel for concrete aggregate and road metal was recovered near Tuttle with a dragline and power shovel by the Titus Sand & Gravel Co. A small quantity of building sand was produced by three operators. Road gravel was mined by two highway districts.

Idaho.—Idaho County was the leading stone-producing county in the State, with an output valued at $713,700. Traprock for roadwork was produced by Frank G. Baulne, Lucile; Carbon Bros., Cottonwood; and James Crick & Sons, Kooskia. Sand and gravel was prepared by three operators for building and paving purposes. The Rocky Mountain Cooperative Prospecting Co. reportedly examined and announced plans to develop a deposit of ruby mica near Kooskia.

Camp Howard (Salmon River) District.—Stream gravels yielded two ounces of gold to Chris Martin while prospecting.

Dixie District.—R. H. Roberts recovered 4 tons of gold concentrate from 45 tons of crude ore at the Star mine. Charles Byam operated a nonfloating washing plant and recovered a few ounces of gold at the Nuggett placer.

Elk City District.—The Clearwater Dredging Co. operation at its Crooked River placers contined to be the principal metal-mining operation in the county; the company operated its bucketline dredge throughout the greater part of the year. Other active placer operations in the district included Tyee Mining Co. (Red River placer), Behrens Bros. (Gold Point placer), John Sheffield (gold recovered by panning behind dredging operations), and J. J. Shuck (Shuck's placer). The only lode-mining operation in the district was that of the C. B. S. Mining Co. at the Haystack mine, where a small quantity of gold and silver was recovered from gold ore by amalgamation.

Orogrande District.—H. O. Noben and J. J. James recovered a small quantity of concentrate containing gold and silver from the Hematite mine.

Simpson District.—L. A. Krampert recovered a few ounces of gold and silver while working stream gravels.

Ten Mile District.—F. J. Rudolph recovered gold and silver by amalgamation from 50 tons of crude ore from the Bob mine, and a considerable quantity of gold and some silver was recovered by Clair Johnson from the Johnson placers. The latter operation treated 200,000 cubic yards of stream gravels.

Warren District.—A small quantity of gold-silver ore was shipped to the Garfield, Utah smelter from the Bear Track No. 1 & 2 property

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by Alvin Mayes. Twin Rivers, Inc., began operating a portable dredge and nonfloating washing plant at the Golden Rule placer on Grouse Creek during the summer. About 14,000 cubic yards of bench gravels was washed. Robert Newcomb recovered a small quantity of gold and silver from stream gravels at the V. J. placer.

Jerome.—Contractors supplied gravel and cinders for roadwork by the State Highway Department. Crews of the Jerome Highway District mined road gravel.

Snake River District.—Sherwood & Larios recovered a quantity of gold from the Sunnyside placer deposit by hydraulicking.

Latah.—Output of stone was valued at $456,300, ranking Latah County second in the State. Road metal was mined by J. F. Konen Construction Co., B. M. Dammarell & G. W. McKeever, and contractors for the State. Hand-cobbed mica from the Muscovite mine near Deary was shipped by the Idaho Beryllium & Mica Corp. to the GSA purchase depot at Custer, S. Dak. The company also produced and shipped to the depot a small quantity of byproduct beryl concentrate. Firebrick was manufactured from fire clay mined by the Troy Firebrick Co. Sand and gravel was recovered for building and paving purposes.

Gold Creek District.—A few ounces of gold was recovered at the Ulman placer deposit by George Guslow.

Hoodoo District.—Harold E. Behrens recovered a substantial quantity of gold and some silver by bucketline dredging stream gravels on the Palouse River about 16 miles east of Harvard.

Lemhi.—Gravel was furnished under contract to the Bureau of Public Roads by the Aslett Construction Co. Several other companies mined gravel for roadwork.

Blackbird District.—Operations at the Calera Mining Co. Blackbird mine near Cobalt were continued on a limited basis most of the year. According to the Howe Sound Co. (parent organization of the Calera Mining Co.) annual report, production was increased at the mine early in the year in anticipation of greater consumption of concentrate at the company Garfield, Utah, refinery. Production was reduced to about 55 percent of capacity later in the year. Nickel contained in the cobalt concentrate was credited to State mineral-production totals. Copper concentrate containing recoverable gold and silver also was produced from the ore and shipped to copper smelters at Garfield, Utah, and Tacoma, Wash.; the company was the largest producer of copper in the State. Diamond drilling conducted under a DMEA exploration project located a new ore-bearing structure which was to be explored and developed with underground drifts.

Blue Wing District.—The Bradley Mining Co. Ima mine continued to be the leading tungsten producer in the State, with its output of high-grade hübnerite concentrate and a smaller byproduct output of scheelite concentrate. The company also produced byproduct copper-lead concentrate containing recoverable lead, copper, silver, and gold. A DMEA exploration program, which included drifting, crosscutting, and diamond drilling, was active during the year at the property.

Eureka District.—Delmar Mining & Milling Co. recovered a few ounces of gold and silver by amalgamation at the Delmar property.

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Junction Mining District.—John Lindskog operated the Leadville mine and produced a small quantity of lead concentrate. Lead ore produced in 1953 at the Buckhorn mine by J. and Herb Cole is included in the State production.

Mackinaw District.—A small quantity of gold was produced by hydraulicking at the K. G. W. and Hawkinsmith placer deposits by W. E. Goff.

McDevitt District.—Rulon Young produced and shipped 310 tons of copper ore from the Grandview property.

Nicholia District.—Small quantities of lead and zinc concentrates and crude lead ore were shipped from the Nicholia mine by Joe E. Zook.

Texas District.—Lead ore was shipped from the Hilltop mine by Rosebud Mines, Inc., and Joseph Hamilton; from the Scott mine by Red Rock Mining & Trucking Co.; from the United Idaho mine by United Idaho Mining Co.; and by W. A. Barnes.

Lewis.—The value of stone produced in Lewis County totaled $407,500, the third highest in the State. The Lewiston Lime Co. continued to operate its limestone quarry and preparation plant on Mission Creek. The Tony Marrazzo Co. produced most of the gravel and crushed stone used in the county.

Minidoka.—Bishop Sand & Gravel Co. and McGill Sand & Gravel Co., both of Rupert, mined sand and gravel for building purposes. A small quantity of pit-run gravel was mined by the Bureau of Reclamation for use at its Minidoka project.

Nez Perce.—Contractors supplied the State Highway Department with road gravel. Dunclick, Inc., marketed building sand and gravel and paving gravel from its pit north of Lewiston.

Owyhee.—Four contractors supplied the State Highway Department with gravel for road construction and maintenance.

Carson (French) District.—Brunzell & Williams produced a quantity of gold and silver by amalgamation at the Trade Dollar group. A small quantity of gold and silver produced before 1954 from the Ben Harrison property was sold during the year.

Snake River District.—Silver-ore production at the Gem State silver mine on Castle Creek was reported by Ben U. Kenison.

South Mountain District.—South Mountain Mining & Concentrating Co. and Harry C. Purdy, operating the South Mountain mine and the Purdy lease of the South Mountain mine, respectively, produced 267 tons of copper ore containing 5 ounces of gold, 5,993 ounces of silver, 16,000 pounds of copper, and 4,000 pounds of lead.

Payette.—Gravel for roadwork was mined for the highway department under contract. The Jensen Brick Co. made structural clay products from locally mined clay at a plant in Payette.

Power.—Mountain States Construction Co., Woodward Construction Co., and Fife Construction Co. provided paving gravel for State highway roadwork. Quartzite was mined by the Westvaco Chemical Division, Food Machinery & Chemical Corp. Output was used at the company elemental phosphorus plant at Pocatello.

Shoshone.—As in previous years, the Coeur d'Alene area continued to be one of the leading silver- lead- and zinc-producing regions in the

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Nation; the county led the State in the production of copper, lead, silver, and zinc, the major metal commodities in the State in terms of quantity and value of output. The county contributed 66 percent of the total value of minerals produced in the State. Depressed lead-zinc prices led to reduction of the workweek (beginning February 1) at many mines from 6 to 5 days; some smaller operations were curtailed because of the low prices; block-leasing arrangements were continued or inaugurated at a number of mines; and where possible, due to the relatively higher price for lead, selective mining of ores higher in lead content in preference to zinc was practiced. Higher labor and material costs offset slight increases in lead and zinc prices over 1953; one compilation [22] showed a decline of 33 percent (from $4,364,644 in 1953 to $2,939,859 in 1954) in the total of dividends paid to stockholders by operations in the Coeur d'Alene district. The total for 1954 was the lowest since 1935.

TABLE 15.—Mine Production of gold, silver, copper, lead, and zinc in the Coeur d'Alene region, Shoshone County, 1945–49 (average), 1950–54, and total 1884–1954, in terms of recoverable metals

Year	Mines producing		Material sold or treated (short tons)	Gold, lode and placer (fine ounces)	Silver, lode and placer (fine ounces)
	Lode	Placer			
1945–49 (average)	58	3	2,751,876	2,453	8,350,142
1950	57	2	2,542,169	3,416	15,056,131
1951	67		2,393,939	2,684	13,639,808
1952	58	2	2,327,536	2,476	13,752,081
1953	43		1,788,426	2,376	13,636,680
1954	37		1,630,250	2,047	14,898,699
1884–1954			(1)	414,673	532,250,213

Year	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1945–49 (average)	2,279,000	139,911,000	153,152,000	$46,005,518
1950	3,791,000	189,394,000	172,205,000	64,555,947
1951	3,748,000	141,140,000	149,978,000	65,058,887
1952	3,724,000	134,660,000	140,632,000	58,459,368
1953	4,200,000	139,770,000	137,300,000	47,729,814
1954	5,132,000	129,624,000	117,472,000	45,515,124
1884–1954	[2] 79,533	[2] 6,129,160	[2] 1,793,082	1,566,340,333

[1] Complete data not available; 1904–54, 96,319,000 short tons.
[2] Short tons.

Labor-contract negotiations between the International Union of Mine, Mill & Smelter Workers and operators in the district led in October to wage increases amounting to about 5 percent plus increased fringe benefits. Under the new contract, effective through June 1955, miners' wages were increased to $14.94 per shift, laborers' to $13.67, and hoistmens' to $16.69.

At the Bunker Hill lead smelter 84,591 tons of lead, 17,155 tons of zinc, 810 tons of copper, 6,015,570 ounces of silver, 5,104 ounces of gold, 40,466 pounds of cadmium, and 845 tons of antimony (contained

[22] Wallace Miner, District Dividends Drop to 20-Year Low in 1954: Vol. 48, No. 48, Dec. 30, 1954.

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in antimonial lead) were produced from company and custom ores, concentrates, and slag received from sources outside as well as within the State. The record lead and zinc output was brought about by the first full-scale usage of new charge-preparation facilities completed in 1953.

The Sullivan electrolytic zinc plant was operated at a reduced rate from February 1 to November 1 owing to restricted sales resulting in the accumulation of an excessively large stock of zinc; plant operations averaged 81.8 percent of capacity during the year. Output totaled 47,404 tons of special high-grade zinc compared with 54,037 tons in 1953. Other production was electrolytic cadmium, 195 tons; zinc, 6,189 tons; lead, 2,902 tons; copper, 149 tons; silver, 709,277 ounces; and gold, 1,633 ounces.

Schmittroth & Etherton operated the Big It mill near Pinehurst; tungsten concentrate meeting National Stockpile specifications was produced from ores and low-grade concentrates received from various operations in Pacific Northwest States.

Crushed stone and gravel for road construction were furnished under contract to the State. Building sand and gravel and a small quantity of paving gravel were mined by the Bunker Hill & Sullivan Mining & Concentrating Co. for company use. According to a report by the Idaho Bureau of Mines and Geology, kyanite and andalusite were found to occur in possibly commercial quantities at Goat Mountain in the southern part of the county.[23]

Beaver District.—The Korsage-Smith & Zanetti Bros. subleases on the Sunset mine (under lease to Day Mines, Inc.) provided the principal production in the district. According to the Day Mines annual report, 16,827 tons of lead-zinc ore was milled at the Rex and Golconda mills. The Blue Grouse mine, operated by Day Mines, yielded lead-zinc ore, which also was treated at the Rex mill.

Coeur d'Alene District.—A small quantity of lead ore was shipped from the Liberty mine by Liberty Mining Co.

Evolution District.—According to the company annual report, Sunshine Mining Co., mined and milled 260,698 tons of ore during the year from the Sunshine mine and adjoining properties operated by the company on a profit-sharing basis. The bulk of the output was from the Omega area (37 percent), followed by the Rotbart (30 percent), Sunshine (14 percent), Rambo (11 percent), Suncon (7 percent), and Snowstorm (less than 1 percent). A total of 7,683 tons of lead-silver concentrate, 4,682 tons of copper-silver-antimony concentrate, and 771 tons of silver-pyrite concentrate was produced. The copper-silver-antimony concentrate was leached of its antimony content before shipment to a smelter; subsequent electrolysis of the leach solution yielded 1,603,726 pounds of antimony cathode metal averaging 95.2 percent antimony. Mill-reconstruction work begun late in 1953 was continued through most of the year; changes included enlargement of the mill building, replacement of all flotation cells, addition of new circuits, and revision of the mill's entire flowsheet. Company mining operations resulted in 7,449 feet of drifting; 3,262 feet of raising; 1,184

[23] Abbott, A. T., and Prater, L. S., The Geology of Kyanite-Andalusite Deposits, Goat Mountain, Idaho, and Preliminary Beneficiation Tests on the Ore: Idaho Bureau of Mines and Geol., Pamph. 100, 1954.

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feet of crosscutting; and 2,192 feet of diamond drilling. Ore reserves were estimated at 678,000 tons for the areas operated by Sunshine Mining Co. The company maintained a 6-day workweek until October 24, when a change to a 5-day week was made. Employee elections held by the National Labor Relations Board in July resulted in replacement of the International Union of Mine, Mill & Smelter Workers by the United Steelworkers of America (CIO) as the employees' bargaining agent.

Polaris Mining Co. operated the Silver Summit mine (Silver Summit and Purim claims) throughout the year; the company annual report showed that output for the year totaled 56,982 tons of ore, compared with 49,483 in 1953. Year-end data showed an increase of 18,900 tons in estimated ore reserves, bringing the total to 62,650 tons. Silver Dollar Mining Co. and Polaris Mining Co. jointly conducted exploratory work at the 3,000, 3,200, and 3,400 levels in the New Purim area; a drift on the Silver Summit 2,500 level was being driven to the west to explore the New Purim area. Zanetti Bros. produced concentrates containing recoverable gold, silver, copper, lead, and zinc from Osburn and DeBlock old tailing; the Osburn tailing yielded 82 tons of lead concentrate and 165 tons of zinc concentrate, and output from the DeBlock tailing totaled 307 tons of lead concentrate and 487 tons of zinc concentrate.

Hunter District.—Output of ore from the Sullivan Mining Co. Star mine totaled 216,877 tons of ore (227,649 tons in 1953), from which 9,033 tons of lead concentrate and 34,769 tons of zinc concentrate were produced. The company reported completion of a new haulage tunnel on the 2,000 level between the Star main shaft and the surface plant at Burke; the tunnel was necessitated by the increasing working depth and by greater water-pumping problems caused by closure of the adjoining Morning mine. Operations at the Morning mine in 1954 by American Smelting & Refining Co. were limited to shaft-pillar extraction after closure of the mine was necessitated in October 1953 by high operating costs and low metal prices. The mine was one of the district's oldest and largest lead-zinc producers, having been worked continuously since the 1880's. Lead-zinc ore output at the Lucky Friday Silver-Lead Mines Co. Lucky Friday mine totaled 31,653 tons, from which 3,180 tons of lead concentrate and 349 tons of zinc concentrate were produced at the Golconda custom mill. The company's main efforts during the year were directed toward continuing work on the three-compartment offset shaft, which was begun in 1953. Completion of the new shaft was expected to result in substantially lower mining and development costs, as well as increased productivity. Other output in the district included lead-zinc ore from the Golconda mine, produced and milled by Golconda Lead Mines, and 52 tons of medium-grade shipping ore produced under a "cleanup lease" at the Day Mines, Inc., Gold Hunter mill.

Lelande District.—The tonnage of lead-zinc ore produced at the American Smelting & Refining Co. Frisco mine declined from 1953. The tonnage of zinc concentrate recovered at the Morning mill from Frisco ore consequently was lower also; however, lead concentrate output was increased. Crude ore and lead and zinc concentrate output from the Hull lease in the Frisco mine declined substantially. According to the Day Mines, Inc., annual report, limited stoping was

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resumed at the Hercules mine above the 1,000 level at midyear to partly offset exploration costs; the company had suspended production at the mine in March 1953 and started an extensive exploration program with DMEA assistance. Seven hundred feet of drifting and 330 feet of raising were completed on the Far West ore body 1,600 level under the program. Lead and zinc concentrates were obtained at the Day Mines, Inc., Sherman mill from ore mined by Jay Heidt, lessee, at the Sherman mine.

Placer Center District.—Ore production from the Day Mines, Inc., Dayrock mine was somewhat less than in 1953 owing to the reduction from a 6- to a 5-day workweek. According to the company annual report, most of the production was from the deposit's Ohio vein, declining quantities being taken from the Freeman and Dora veins. At the company Tamarack mine all operations were conducted by lessees; ore was taken from eight levels of the mine, each being worked by a separate group of lessees. The total output (23,054 tons of ore) was treated at the Tamarack mill. Production of developmental ore from the Galena mine, owned by Vulcan Silver-Lead Co. and leased to and being developed jointly by American Smelting & Refining Co. (controlling interest) and Day Mines, Inc., was increased substantially over 1953. Results of the exploration work on the ore body discovered in 1953 on the 3,000 level were encouraging; ore reserves were increased substantially, according to company reports. Sinking of the main shaft 400 feet to the 3,400 level and an escapeway-ventilation system were completed, and plans were to place the mine on an operating basis early in 1955. Zanetti Bros. mill in Lake Gulch, which had been rented during the development period, was purchased and the capacity increased from 150 to 350 tons per day.

Summit District.—Lead and zinc concentrates were produced at the Golconda custom mill from 336 tons of crude ore shipped from the Smith & Murphy lease on the Orofino mine. Other production in the district was reported by Ione Mining Co. (Ione mine), McDaniel and St. Peter (Myrtle mine), and D. A. Phillips (Terrible Edith mine).

Yreka District.—Output of ore from the Bunker Hill & Sullivan Mining & Concentrating Co. Bunker Hill mine, by far the State's largest lead producer and the second-ranking silver producer, increased somewhat over 1953. According to the company annual report, mine production of metals recovered was: Lead, 30,446 tons; zinc, 6,837 tons; and silver, 2,235,510 ounces. The figures for zinc and silver represented declines from 1953; however, the lead production was higher by about 1,500 tons. The company reported that development work on the Shea ore body in the northwest portion of the mine was encouraging and promised to add substantially to ore reserves. Exploration and development at the company Crescent mine, reopened in 1953, included deepening the Crescent shaft to the 3,110-foot level and completing 2,644 feet of lateral work. A report on the work was published.[24]

Ore was produced from the John George lease on the upper levels of the Bunker Hill mine. Old slag treated at the Bunker Hill smelter and slag-fuming plant yielded substantial quantities of silver, lead,

[24] McDougall, S. W., and Olds, E. B., Sinking the Crescent Shaft: Min. Cong. Jour., vol. 40, No. 9, September 1954, p. 24.

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and zinc, which were credited to district totals. Spokane-Idaho Mining Co. reported production of 13,264 tons of ore yielding 357 tons of lead concentrate and 2,097 tons of zinc concentrate from the Constitution mine and 8,301 tons of ore yielding 107 tons of lead concentrate and 1,403 tons of zinc concentrate from the Douglas mine.

Ore production from the Highland-Surprise Consolidated Mining Co. Highland-Surprise mine totaled 6,679 tons, from which 275 tons of lead concentrate and 978 tons of zinc concentrate were obtained. According to the company annual report, results of exploration at the mine under a DMEA loan were very discouraging, and all underground operations were discontinued. The company entered into an agreement with Sidney Mining Co. which provided for exploration of the Highland-Surprise property by Sidney through the adjoining Nevada-Stewart Mining Co. property. The output of lead and zinc concentrates from the Sidney mine by Sidney Mining Co. was somewhat less than in 1953. The company annual report showed a decline of 47 percent in tonnage of ore produced; however, owing to production of higher grade material from the mine's old upper workings under an incentive block-leasing plan, output of concentrate declined only 15 percent. Output of lead-zinc ore from the Page mine, operated by American Smelting & Refining Co., was appreciably less than in 1953; however, the mine was the third-ranking producer of lead and zinc in the State. Sunset Mines, Inc., produced 3,981 tons of ore yielding 100 tons of lead concentrate and 351 tons of zinc concentrate from the Liberal King mine. Production was reported by lessees from the Mascot Mines, Inc., Little Pittsburgh mine (company operations were suspended in August 1953 because of low metal prices) and the Nabob Silver-Lead Co. Nabob mine.

Twin Falls.—Building sand and gravel was mined by the Sumner Sand & Gravel Co., Buhl; McCarty Gravel Co., Kimberly; and Colonial Concrete Co., Hansen. Highway district crews produced gravel for construction and maintenance. Contractors supplied the needs of the State highway crews for sand and gravel and crushed stone.

Valley.—Mercury production was continued throughout the year at the Hermes mine near Stibnite by the United Mercury Mines Co. Except for workers engaged in maintenance and exploration work, the Bradley Mining Co. Yellow Pine mine remained idle during the year. Baumhoff-Marshall, Inc., and Idaho-Canadian Dredging Co. operated 6-cubic foot Yuba-type bucketline dredges near Cascade. Dredge concentrates were shipped to the Baumhoff-Marshall, Inc., sand plant at Boise for separation and sale of monazite concentrate. Bradley Mining Co. operated the open-pit Springfield tungsten mine and processed 12,000 tons of crude ore, using magnetic separators at a plant at Stibnite. A total of 1,522 units of high-grade (over 70 percent) scheelite concentrate was shipped to the GSA, and about 8 tons of low-grade (9 percent) material was shipped to the Salt Lake Tungsten Co. for treatment. Ore from the pit averaged about 0.25 percent WO_3. At the Snow Bird property McRae Tungsten Corp. mined 922 tons of hübnerite and scheelite ore, from which 11 tons of high-grade concentrates and 26 tons of low-grade concentrates were produced.

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Contractors furnished the Bureau of Public Roads with paving sand and gravel and the State with road gravel.

Warren District.—T. W. Frank (Golden West Mines, Inc.) recovered a small amount of gold from stream gravels.

Washington.—R. M. Caseman produced a small quantity of manganese ore from the Sturgill No. 1 and No. 2 property during the year. The ore was shipped to the National Stockpile depot at Butte, Mont.

Melvin Taylor & Sons, operating the Northwest Gypsum Co. gypsum deposit near Weiser, substantially increased the production of land plaster.

Snake River District.—A few ounces of gold was recovered from a placer operation by C. H. Phillips and Ernest Rogers.

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The Mineral Industry of Illinois

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Illinois State Geological Survey.

By D. H. Mullen [1]

MINERAL PRODUCTION in Illinois in 1954 was valued at $473.1 million, an increase of $10.6 million or nearly 2 percent over 1953. The greatest value was in the fuels, consisting of coal, natural gas, petroleum, and peat, which were valued at $373.1 million or nearly 79 percent of the total mineral output. Nonmetallic minerals were valued at $96 million, or 20 percent of the total, and metals, lead, silver, and zinc were valued at $4 million or 1 percent of the total. In value, increases were recorded in petroleum, 17 percent; natural-gas liquids, 33 percent; sand and gravel, 27 percent; lime, 6

TABLE 1.—Mineral production in Illinois, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement, portland ---- 376-pound barrels	8,651,385	$21,961,761	9,109,076	$23,147,871
Clays	2,305,202	4,573,001	2,027,092	3,482,450
Coal	46,009,891	181,597,998	41,971,136	160,213,063
Fluorspar	163,303	8,567,026	107,830	5,989,219
Lead (recoverable content of ores, etc.)	3,391	888,442	3,232	885,568
Lime (open-market)	519,992	6,986,560	532,051	7,420,849
Natural gas ---- million cubic feet	9,282	1,559,000	9,475	1,345,000
Peat	2,151	(2)	(3)	(3)
Petroleum (crude) ---- thousand 42-gallon barrels	59,026	170,590,000	[3] 66,798	[3] 199,060,000
Sand and gravel [4]	21,521,806	20,540,549	24,443,055	26,164,387
Sand and sandstone (ground)	276,215	2,461,767	(5)	(5)
Silver (recoverable content of ores, etc.) troy ounces	2,338	2,116	1,160	1,050
Stone (except limestone for cement and lime 1953)	22,938,732	29,736,966	26,407,088	31,134,135
Zinc (recoverable content of ores, etc.)	14,556	3,347,880	14,427	3,116,232
Undistributed: Iron oxide pigments (1954), natural gasoline, LP-gases, elemental sulfur, tripoli, and minerals whose value must be concealed in certain years (indicated in appropriate column by footnote reference 2)	----	9,629,924	----	13,060,485
Total Illinois	----	462,443,000	----	[6] 473,077,000

[1] Production as measured by mine shipments, sales or marketable production (including consumption by producers).
[2] Included with "Undistributed."
[3] Final figure supersedes preliminary figures in commodity chapter.
[4] Includes friable sandstone.
[5] Beginning with 1954, ground sand and sandstone included with sand and gravel or stone.
[6] Total adjusted to eliminate duplication of clays and stone.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Minneapolis, Minn.

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percent; cement, 5 percent; and stone, 4 percent. Decreases were noted in the value of coal, 12 percent; natural gas, 14 percent (production increased 2 percent); clays, 24 percent; fluorspar, 30 percent; lead, less than 1 percent; zinc, 7 percent; and silver, 50 percent.

The principal producing counties, in order of value of the total mineral output (exclusive of petroleum and natural gas), were La Salle, Williamson, Christian, Fulton, Cook, Franklin, St. Claire, Perry, and Saline. Coal was the leading economic mineral in all the counties listed except La Salle and Cook. Cement manufacture and the production of sand and gravel were the important mineral industries in La Salle County. Cook County produces substantial portions of the State limestone and lime and also contains the large consuming centers of the Chicago area.

Some of the production data for 1954 were collected jointly with the Bureau of the Census, United States Department of Commerce. Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences of coverage.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS[2]

Coal.—Production of bituminous coal in 1954 totaled 42 million tons valued at $160.2 million, or nearly 9 percent below 1953. The State maintained its position of 4th among the States, producing nearly 11 percent of the Nation's bituminous coal. Production in 1954 was reported by 206 mines, operating in 37 of the State's 102 counties. Of the 206 mines, 87 were classed as shipping mines and 119 as local mines or those whose production was consumed in the immediate vicinity of the mine. Fifty-nine of the shipping mines were shaft mines and 28 strip operations. Williamson County ranked first in production, replacing Christian County, the major producing county in 1953. Production exceeding 1 million tons was reported in 12 counties, and 5 counties reported production exceeding 500,000 tons.

Peat.—Production of peat was reported in Tazewell County; it increased 59 percent in volume and 397 percent in value over 1953. The peat was used entirely as a soil conditioner and for horticultural uses.

Petroleum and Natural Gas.—Petroleum produced in 1954 was 66.8 million barrels valued at $199 million, an increase of 7.8 million barrels or 13 percent in quantity and $28.5 million or 17 percent in value over 1953. The State ranked 8th in the United States, pro-

[2] Data, except for peat and for production and value, from Seventy-Third Coal Report of Illinois Department of Mines and Minerals; and Mineral Production in Illinois in 1954, Illinois State Geol. Survey, Cir. 206, 1955, 59 pp.

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ducing about 3 percent of the Nation's total. Petroleum was produced in 34 counties. Ten fields reported production of more than 1 million barrels each. New wells completed totaled 1,383. Hydraulic fracture treatment was responsible for an increase in the percentage of successful well completions during the year. About 70 percent of all new wells in 1954 were so treated. Repressuring oil-bearing-formations with water, gas, air, or a combination of the three agents continued to be an important part of production operations. In 1954, 23 percent of the total production was credited to secondary recovery; and, of the nearly 8-million-barrel increase, 3 million barrels was estimated to be from increased recovery because of repressuring.

Production of natural gas increased 193 million cubic feet (2 percent) in volume over 1953, but the value decreased $214,000 (14 percent). Compression and absorption methods were used to produce natural gasoline and natural-gas liquids. The value of production increased 33 percent over 1953.

NONMETALS

Cement.—Portland cement was produced at 3 plants in La Salle County and 1 in Lee County. Cement was fifth in economic importance in the State mineral industry in 1954. Shipments were 9.1 million barrels valued at $23.1 million, a 5-percent increase in quantity and value over 1953. Production declined 27,494 barrels or less than 1 percent, and stocks declined 267,228 barrels or 32 percent. The average value per barrel for portland cement was $2.54 in both 1954 and 1953. Masonry cement manufactured from portland cement or portland-cement clinker and other materials also was produced.

TABLE 2.—Finished portland cement produced, shipped, and in stock, 1945–49 (average) and 1950–54

Year	Active plants	Production (barrels)	Shipments from mills			Stocks at mills on Dec. 31 (barrels)
			Barrels	Value		
				Total	Average per barrel	
1945–49 (average)	4	6,712,625	6,714,138	$12,760,316	$1.90	564,166
1950	4	7,924,079	7,857,969	16,920,234	2.15	695,490
1951	4	8,483,783	8,377,387	19,853,132	2.37	801,886
1952	4	8,514,443	8,710,621	20,600,347	2.36	605,708
1953	4	8,869,342	8,651,385	21,961,761	2.54	823,665
1954	4	8,841,848	9,109,076	23,147,871	2.54	556,437

Clays.—The production of fire and miscellaneous clay in 1954 was 2 million tons valued at $3.5 million, a decrease of 12 percent in volume and 24 percent in value from 1953.

Fire clay was produced by 12 operators in 8 counties. The major producing areas were in Grundy and La Salle Counties. The principal uses were the manufacture of pottery, stoneware, firebrick and blocks, zinc retorts, heavy clay products and mortar, and foundries. The production of fire clay in 1954 was 313,679 tons valued at $675,407, a 15-percent decrease in volume and 54-percent drop in value from 1953.

Miscellaneous clay for the manufacture of pottery, building brick,

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heavy clay products, lightweight aggregates, and cement was produced by 32 operators in 22 counties. Deposits in Cook, Livingston, and Vermillion Counties were the major sources. Production in 1954 was 1.7 million tons valued at $2.8 million, a decrease of 12 percent in volume and 9 percent in value from 1953.

TABLE 3.—Clays sold or used by producers, 1945–49 (average) and 1950–54 by kinds

Year	Fire clay		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	335,455	$939,544	1,775,794	$1,483,103	[1] 2,143,566	[1] $2,746,247
1950	433,423	1,431,372	2,086,008	1,966,336	2,519,431	3,397,708
1951	492,127	1,774,870	2,097,013	2,249,324	2,589,140	4,024,194
1952	450,444	1,544,668	1,886,299	2,324,583	2,336,743	3,869,251
1953	367,385	1,473,859	1,937,817	3,099,142	2,305,202	4,573,001
1954	313,679	675,407	1,713,413	2,807,043	2,027,092	3,482,450

[1] Includes 32,317 tons of fuller's earth valued at $323,600.

Fluorspar.—Shipments of fluorspar in 1954 were 107,800 tons valued at $6 million, a decrease of 34 percent in quantity and 30 percent in value compared with 1953. The State continued to lead the Nation in production and shipments.

The decline resulted largely from reduced operations at steel plants and the increase of imports, principally from Mexico. Many leading operators sharply curtailed operations, and smaller producers ceased production. Thirty-one producers operated an estimated 40 mines. The leading producers were the Aluminum Co. of America, Ozark-Mahoning Co., Minerva Oil Co., Mackey-Humm Fluorspar Mining Co., and Rosiclare Lead & Fluorspar Mining Co.

Exploration of fluorspar deposits under contracts with Defense Minerals Exploration Administration continued in Hardin and Pope Counties. Two contracts were in effect the entire year; and 2 additional contracts, 1 each in Hardin and Pope Counties, were approved.

Fluorspar shipped in 1954 was used as a chemical raw material in manufacturing hydrofluoric acid and in producing aluminum, 64 percent; in manufacturing glass, enamel, brick, and tile, 19 percent; as a flux in iron foundries and steelmaking, 14 percent; and for miscellaneous uses, 3 percent. Shipments, classified as to grade, were: Acid, 64 percent; Ceramic, 19 percent; and Metallurgical, 17 percent.

The average value of Acid Grade was $63.26 a ton in 1954 and $64.13 in 1953, a decrease of 1 percent; Ceramic Grade was $48.73 in 1954 and $52.66 in 1953, a decrease of about 8 percent, and Metallurgical Grade was $33.67 in 1954 and $37.35 in 1953, a decrease of 10 percent. The weighted average value of all grades shipped from Illinois was $55.54 in 1954 and $52.46 in 1953, a 6-percent increase. The increase in the average value of all grades resulted from the decreased use of Metallurgical Grade ($33.67 per ton) for flux in iron foundries and steelmaking.

Because of decreased consumption in the steel industry and the increase of imports, the Tariff Commission initiated a study of production, trade, imports, and consumption of fluorspar in the United States and the effect of the present tariff rates on the domestic indus-

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try. In August the General Services Administration announced that the Office of Defense Mobilization had authorized the purchase of Metallurgical-Grade fluorspar for the National Stockpile. Only a small tonnage was reported purchased by the end of the year.

TABLE 4.—DMEA contracts in effect in 1954

Contractor	County	Commodity	Contract		
			Date	Total amount	Government participation percent
Ozark-Mahoning Co	Hardin	Fluorspar	Feb. 18, 1952	$122,715	50
Do	Pope	do	July. 15, 1954	22,240	50
Goose Creek Fluorspar Mining Co.	Hardin	Fluorspar, lead, and zinc.	Sept 1, 1954	6,800	50
Minerva Oil Co	Hardin and Pope.	Fluorspar	June 15, 1953	36,014	50

TABLE 5.—Fluorspar shipped from mines, 1945–49 (average) and 1950–54

Year	Short tons	Value	
		Total	Average per ton
1945–49 (average)	152,475	$5,520,216	$36.20
1950	154,623	6,110,765	39.52
1951	204,328	9,294,703	45.49
1952	188,293	9,481,223	50.35
1953	163,303	8,567,026	52.46
1954	107,830	5,989,219	55.54

Lime.—Lime was produced in Adams, Cook, and St. Clair counties by 4 companies operating 6 plants. The principal uses were for building, refractory, chemical, and industrial applications.

Production in 1954 was 532,000 tons valued at $7.4 million, an increase of 2 percent in volume and 6 percent in value over 1953.

Perlite.—Crude perlite from sources in Western and Southwestern States was expanded at plants in Cook, Champaign, and Will Counties. The expanded material was used as a lightweight aggregate in plasters and concrete, filter aids, soil conditioners and in the manufacture of industrial products. Production in 1954 was 10,952 tons valued at $573,513.

Sand and Gravel including Sand and Sandstone (Ground).—Sand and gravel was produced in 67 of the State's 102 counties. The principal use was for building and paving. Other uses were for glass manufacture, molding, grinding and polishing, engine, filter, railroad ballast, and other purposes.

Friable sandstone mined from sandstone beds was produced in La Salle and Ogle Counties. The material is nearly pure silica and was used for manufacturing high-grade glass, in foundries, and for abrasives. A portion of the production was ground and used in refractories, abrasives, fillers, and pottery.

Production in 1954 of sand and gravel and silica sand was 24.4 million tons valued at $26.2 million, an increase of 14 percent in volume and 27 percent in value over 1953. Of the total, 20.2 million

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tons or 83 percent was used for building and paving. The principal producing counties were La Salle, Will, McHenry, Winnebago, and Peoria. The major producers were Chicago Gravel Co., Consumers Co., Material Service Corp., and Wedron Silica Co., all of Chicago; Elmhurst-Chicago Stone Co., Elmhurst; Lincoln Sand & Gravel Co. and McGrath Sand & Gravel Co., Lincoln; and Missouri–Illinois Materials Co., St. Louis, Mo.; Ottawa Silica Co. and Standard Silica Co., Ottawa.

TABLE 6.—Sand and gravel sold or used by producers, 1953–54, by classes of operations and uses

	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
COMMERCIAL OPERATIONS						
Sand: [1]						
Glass	1,257,364	$2,879,382	$2.29	(2)	(2)	
Molding	1,020,423	2,343,187	2.30	731,664	$1,985,273	$2.71
Building	4,428,688	3,274,134	.74	5,775,150	4,267,837	.74
Paving	3,230,802	2,318,874	.72	2,070,194	1,548,895	.75
Grinding, polishing, and blast	135,557	528,476	3.90	(2)	(2)	
Fire or furnace	39,058	173,599	4.44	(2)	(2)	
Engine	108,497	100,621	.93	81,005	80,026	.99
Filter	14,458	74,347	5.14	24,940	51,884	2.08
Railroad ballast	44,640	27,493	.62	(2)	(2)	
Other	575,314	1,204,733	2.09	1,095,094	4,511,807	4.12
Undistributed [3]				1,247,387	3,379,263	2.71
Total commercial sand	10,854,801	12,924,846	1.19	11,025,434	15,824,985	1.44
Gravel:						
Building	3,724,300	2,908,330	.78	4,895,015	4,280,922	.87
Paving	4,867,033	3,526,256	.72	5,707,606	4,271,289	.75
Railroad ballast	962,335	531,440	.55	655,363	398,934	.61
Other	326,466	211,717	.65	412,972	321,707	.78
Total commercial gravel	9,880,134	7,177,743	.73	11,670,956	9,272,852	.79
Total commercial sand and gravel	20,734,935	20,102,589	.97	22,696,390	25,097,837	1.11
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Paving	138,769	73,787	.53	200,861	113,102	.56
Total Government-and-contractor sand	138,769	73,787	.53	200,861	113,102	.56
Gravel:						
Building	29,450	13,085	.44			
Paving	618,652	351,088	.57	1,545,804	953,448	.62
Total Government-and-contractor gravel	648,102	364,173	.56	1,545,804	953,448	.62
Total Government-and-contractor sand and gravel	786,871	437,960	.56	1,746,665	1,066,550	.61
ALL OPERATIONS						
Sand	10,993,570	12,998,633	1.18	11,226,295	15,938,087	1.42
Gravel	10,528,236	7,541,916	.72	13,216,760	10,226,300	.77
Grand total	21,521,806	20,540,549	.95	24,443,055	26,164,387	1.07

[1] Includes friable sandstone.
[2] Included with "Undistributed" to avoid disclosure of individual company operations.
[3] Includes glass, grinding and polishing, blast, fire or furnace, and railroad-ballast sand.

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Stone.—Stone produced consisted of dimension and crushed limestone and crushed sandstone. The principal use of limestone was for concrete aggregate and roadstone and for agricultural use. Crushed sandstone from Alexander County was used as ganister in steel furnaces. Cook, Will, and Kankakee were the major limestone-producing counties.

Production of all stone in 1954 totaled 26.4 million tons valued at $31.1 million, an increase of 15 percent in volume and 4 percent in value. Of the total, 18 million tons (68 percent) was used for concrete aggregate and road construction and 2.8 million tons (11 percent) for agricultural purposes.

The principal producers of limestone were: Allied Chemical & Dye Corp., Syracuse, N. Y.; Columbia Quarry Co., East St. Louis, Mo.; Consumers Co., Chicago; Doles & Shephard Co., La Grange; East St. Louis Stone Co., East St. Louis, Mo.; Elmhurst-Chicago Stone Co., Elmhurst; Lincoln Stone Co., Joliet; Lehigh Stone Co., Kankakee;

TABLE 7.—Limestone sold or used by producers, 1953–54, by uses

Use	1953			1954		
	Quantity	Value		Quantity	Value	
		Total	Average per unit of measure		Total	Average per unit of measure
Dimension:						
Building:						
Rough construction short tons	75	$525	$7.00	750	$3,375	$4.50
Rubble do	(1)	(1)		1,352	5,039	3.73
Rough architectural cubic feet	(1)	(1)	.41	776	325	.42
Dressed:						
Cut stone do	3,824	9,750	2.55	2,646	6,750	2.55
Curbing and flagging do	31,963	18,349	.57	21,144	15,577	.74
Undistributed	22,892	121,970	5.33			
Total (equivalent short tons approximate) [2]	25,980	150,289	5.78	4,190	31,066	7.41
Crushed and broken:						
Riprap:						
Commercial short tons	141,110	178,853	1.27	40,418	56,467	1.40
Noncommercial do	100	50	.50	60,000	48,000	.80
Flux do	288,583	475,980	1.65	150,487	250,912	1.67
Concrete aggregate, roadstone, screenings:						
Commercial short tons	16,747,997	20,854,860	1.25	16,451,000	21,179,736	1.29
Noncommercial do	607,887	691,839	1.14	1,550,469	1,305,162	.84
Railroad ballast do	1,162,791	1,257,591	1.08	652,212	716,369	1.10
Agriculture:						
Commercial do	2,867,486	3,847,163	1.34	2,782,098	3,608,787	1.30
Noncommercial do				3,800	3,590	.94
Other:						
Commercial do	1,094,313	2,265,616	2.07	[3] 4,712,119	3,927,556	.83
Noncommercial do	1,669	1,669	1.00			
Total commercial do	22,302,280	28,880,063	1.29	24,788,334	29,739,827	1.20
Total noncommercial do	609,656	693,558	1.14	1,614,269	1,356,752	.84
Total crushed and broken short tons	22,911,936	29,573,621	1.29	26,402,603	31,096,579	1.18
Total limestone do	22,937,916	29,723,910	1.30	26,406,793	31,127,645	1.18

[1] Included with "Undistributed" to avoid disclosure of individual company operations.
[2] Average weight 170 pounds per cubic foot.
[3] Includes limestone used for cement and lime, 1954.

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Materials Service Co., Chicago; and National Stone Co., Joliet. Western Fire Brick Co., Granite City, produced sandstone.

Tripoli.—Tripoli or amorphous silica was mined from nearly horizontal beds in northern Alexander County. The cleaned and graded product was used as an abrasive and as filler material.

Vermiculite.—Crude vermiculite produced in various Western States was exfoliated at plants in Cook, Macoupin, and Will Counties. The exfoliated product was used for manufacturing of insulating materials and as a lightweight aggregate in plaster and concrete.

METALS

The combined value of lead, silver, and zinc production, declined nearly 6 percent from 1953. Metal-mining operations were active in Jo Daviess County in Northern Illinois and Hardin County in Southern Illinois. In Hardin County lead, silver, and zinc were produced as byproducts or coproducts of fluorspar mining. Jo Daviess County mines produced 61 percent of the State lead and 69 percent of its zinc, reflecting the decline in fluorspar mining in Hardin County, where the bulk of the lead is normally produced. Silver was recovered from lead concentrate produced in Hardin County. The silver content of the concentrate was so low that silver was recovered only when silver-free lead was made by the refineries. Fifty percent less silver was recovered in 1954 than in 1953. The principal producers in Jo Daviess County were Tri-State Zinc, Inc., and Eagle-Pitcher Co. In Hardin County, Ozark-Mahoning Co., Minerva Oil Co., and Aluminum Co. of America were the principal producers.

REVIEW BY COUNTIES

Adams.—Sand and gravel, stone, and lime were produced in 1954. Of greatest value was limestone, used for flux, riprap, concrete aggregate, road material, agricultural lime, mineral food, and various chemical and industrial purposes. Major producers were Black & White Limestone Co., Menke Stone & Lime Co., and Marblehead Lime Co., all of Quincy. The last two companies also produced lime for building, chemical, and industrial uses. Sand and gravel for building and paving was produced by Quincy Sand Co., Quincy, and Blick's Construction Co. The State highway commission contracted for road sand.

Alexander.—The mines and quarries of Alexander County yielded clays, sand and gravel, stone, and tripoli. Producers of tripoli were Ozark Minerals Co., at Elco; and Tamms Industries, Inc., which operated the Alex mill near Tamms. Products were employed for abrasives, filler, and other uses. H. H. Halliday Sand Co., Cairo, operated a dredge on the Ohio River. Engine and road sand and sand and gravel for building use were produced. Western Fire Brick Co., Granite City, produced crushed sandstone for furnace and converter linings. A small quantity of miscellaneous clay was mined from the Ozark Minerals Co., pit at Fayville.

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TABLE 8.—Value of mineral production in Illinois, 1953–54, by counties [1]

County	1953 [2]	1954	Minerals produced in 1954 in order of value
Adams	$972,042	$1,050,343	Stone, lime, sand and gravel.
Alexander	(3)	598,260	Tripoli, sand and gravel, sandstone, clays.
Bond	79,984	82,730	Clays, sand and gravel.
Boone	(3)	116,259	Sand and gravel, stone.
Brown	(3)	98,347	Sand and gravel, clays.
Bureau	3,029,448	(3)	Coal, sand and gravel, clays.
Calhoun	(3)	13,140	Stone, sand and gravel.
Carroll	(3)	111,543	Sand and gravel, stone.
Champaign	(3)	147,761	Sand and gravel.
Christian	22,991,942	(3)	Coal.
Clark	423,515	458,151	Stone, sand and gravel, coal.
Clay		(3)	Coal.
Clinton	(3)	(3)	Coal, stone, sand and gravel.
Coles	(3)	377,458	Stone, sand and gravel.
Cook	17,758,241	19,809,465	Stone, lime, clays, sand and gravel.
Crawford	(3)	(3)	Sand and gravel.
Cumberland	(3)	16,790	Do.
De Kalb	(3)	279,913	Do.
De Witt	(3)	52,522	Do.
Douglas	992,860	(3)	Coal, sand and gravel.
Du Page	(3)	1,638,994	Stone, sand and gravel.
Edwards	41,400	46,511	Clays.
Effingham	(3)	90,957	Stone, sand and gravel.
Fayette	(3)	82,367	Sand and gravel, clays.
Ford		(3)	Sand and gravel.
Franklin	21,396,944	(3)	Coal.
Fulton	(3)	19,303,507	Coal, sand and gravel, stone.
Gallatin	599,132	379,058	Coal, sand and gravel.
Greene	237,114	132,518	Stone, clays, coal.
Grundy	3,021,390	2,289,535	Sand and gravel, clays, coal.
Hancock	250,909	384,491	Stone, coal.
Hardin	10,104,334	7,449,042	Fluorspar, zinc, lead, stone, silver.
Henderson	(3)	183,916	Stone.
Henry	(3)	(3)	Coal, sand and gravel.
Iroquois		4,452	Sand and gravel.
Jackson	(3)	(3)	Coal, stone.
Jefferson	6,046,906	(3)	Coal.
Jersey	(3)	160,204	Stone, sand and gravel.
Jo Daviess	(3)	2,701,037	Zinc, lead, stone.
Johnson	(3)	644,105	Stone.
Kane	(3)	976,629	Sand and gravel, stone.
Kankakee	4,847,786	4,470,208	Coal, stone, clays, sand and gravel.
Kendall	(3)	196,427	Stone, sand and gravel.
Knox	(3)	6,702,679	Coal, clays, sand and gravel.
Lake	(3)	553,876	Sand and gravel, clays.
La Salle	28,306,430	29,490,666	Cement, sand and gravel, stone, clays, coal.
Lawrence	92,051	74,665	Sand and gravel.
Lee	4,168,610	4,607,951	Cement, stone, sand and gravel.
Livingston	1,013,463	1,470,449	Stone, clays, sand and gravel, coal.
Logan	(3)	759,092	Sand and gravel, stone, coal.
Macon	(3)	347,421	Sand and gravel.
Macoupin	4,329,027	2,628,454	Coal.
Madison	5,014,899	3,828,008	Coal, stone, clays, sand and gravel.
Marion	(3)	(3)	Coal.
Marshall	(3)	246,117	Sand and gravel, clays.
Mason		7,610	Sand and gravel.
Massac	(3)		
McDonough	(3)	339,446	Stone, clays.
McHenry	1,121,906	1,370,748	Sand and gravel, stone.
McLean	251,965	(3)	Sand and gravel.
Menard	(3)	182,256	Stone, coal, clays.
Mercer	(3)	158,118	Stone, clays.
Monroe	(3)	715,924	Stone.
Montgomery	(3)	(3)	Coal, stone, sand and gravel.
Ogle	971,832	1,078,704	Sand and gravel, stone.
Peoria	3,490,162	3,010,690	Coal, sand and gravel, stone.
Perry	15,371,857	11,598,325	Coal.
Pike	(3)	227,224	Sand and gravel, stone.
Pope	(3)	227,650	Fluorspar, sand and gravel.
Pulaski	(3)	153,042	Stone, clays.
Randolph	(3)	5,903,628	Coal, stone, sand and gravel.
Rock Island	815,354	750,849	Stone, sand and gravel, clays.
St. Clair	15,686,145	12,530,914	Coal, stone, sand and gravel, lime, clays
Saline	13,514,975	9,499,403	Coal.
Sangamon	1,146,968	1,053,032	Coal, sand and gravel, clays.
Schuyler	140,854	133,153	Coal, sand and gravel.
Scott	(3)	58,196	Stone, sand and gravel.
Shelby	(3)	44,545	Sand and gravel.
Stark		18,800	Do.
Stephenson	(3)	87,165	Stone, sand and gravel

See footnotes at end of table, p. 390.

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TABLE 8.—Value of mineral production in Illinois, 1953–1954, by counties[1]—Con.

County	1953 [2]	1954	Minerals produced in 1954 in order of value
Tazewell	$853,627	$1,025,825	Sand and gravel, peat, clays, coal.
Union	(3)	405,368	Stone, sand and gravel.
Vermilion	(3)	3,540,553	Coal, clays, sand and gravel.
Wabash	178,325	191,792	Sand and gravel.
Warren	(3)	98,700	Stone, coal.
Washington	(3)	(3)	Coal.
White	(3)	179,609	Sand and gravel.
Whiteside	418,765	231,317	Sand and gravel, stone.
Will	5,535,171	3,914,421	Sand and gravel, stone, coal, sulfur.
Williamson	23,244,561	22,185,405	Coal, stone.
Winnebago	(3)	1,533,447	Sand and gravel, stone.
Woodford	102,492	(3)	Sand and gravel.
Undistributed	243,879,604	275,564,998	
Total	462,443,000	473,077,000	

[1] County figures exclude petroleum, natural gas, natural gas liquids, and some stone and some sand and gravel for which data by county are unavailable; included with "Undistributed." The following counties are not listed because no production was reported: Cass, Edgar, Hamilton, Jasper, Morgan, Moultrie, Piatt, Putman, Richland, and Wayne Counties.
[2] Revised figures.
[3] Included with "Undistributed."

Bond.—Greenville Gravel Co., Inc., Greenville, and W. D. Lindsey and Munie Gravel Pit, both of Keyesport, produced sand and gravel for structural and paving uses. Shale for manufacturing heavy clay products was mined by Richards Brick Co., New Douglas.

Boone.—Christensen & Smith, Capron, produced road gravel from four pits. Spencer Sand & Gravel, Belvidere, produced sand and gravel for road use. The Boone County Highway Department and the State highway commission contracted for road gravel. Belvidere lime quarry, Belvidere, produced limestone for concrete aggregate, roadstone, and agriculture.

Brown.—Sand and gravel for building and road use was produced by Aber & Fry and T. F. Hollembeak, both of Mount Sterling. Miscellaneous clay for manufacturing heavy clay products was produced by Frederick Brick & Tile Co., Mount Sterling.

Bureau.—Bituminous coal was produced by Midland Electric Coal Corp. from its No. 1 mine at Atkinson. Sand and gravel pits active during the year were operated by Floyd E. Clapp, Walnut; Hansen Bros., New Bedford; Frank J. Poscharscky, Wyanet; Western Sand & Gravel Co., Spring Valley; and the Bureau County Highway Department. Molding sand and sand and gravel for building construction, roads, and railroad ballast were produced. The State highway commission contracted for sand and gravel. Clay for miscellaneous heavy clay products was produced by Sheffield Shale Products Co., Sheffield.

Calhoun.—Ellis Inman, Botchtown, pumped sand from the Mississippi River for building use. The State highway commission contracted for road gravel. Paul E. Herter, Golden Eagle, produced limestone for flagging, riprap, concrete aggregate, roadstone, and agriculture.

Carroll.—Howard Nelson, Lanark, produced road gravel, and Nicol Sand Co., Savanna, mined and processed natural bonded molding, engine, blast, and asphalt sands. Contracts for sand and gravel were placed by the Carroll County Highway Department, the State highway commission, and Mount Carroll Township. Minor Bros., Rock

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Falls, produced limestone for concrete aggregate, roadstone, and agriculture.

Champaign.—Sand and gravel, mostly for building construction and road use was produced by Gibson Bros. and West Champaign Gravel Co., both of Champaign; and Mahomet Sand & Gravel Co., Inc., and W. H. Troike Co., Mahomet. Ryolex Corp., Champaign, produced expanded perlite for plaster aggregate, and other uses from crude perlite from Southwestern States.

Christian.—Christian County ranked second in the State in the production of bituminous coal and third in value of mineral production. Peabody Coal Co., operated the No. 8 mine at Toney, the No. 10 mine at Pawnee and the No. 17 mine at Pana.

Clark.—Casey Stone Co., Casey, and Ralph E. Montgomery and Quality Lime Co., Marshall, produced limestone for concrete aggregate, roadstone, and agricultural uses. Barthelemy & Lawrence, West Union, pumped road gravel from a wet pit. Rock Hill Coal Co. produced bituminous coal at West Union—the first recorded production of coal in Clark County.

Clinton.—The Clinton County Highway Department produced road gravel. Huelsman Quarry, Carlyle, produced limestone for concrete aggregate, roadstone, and agricultural use. Breese Coal Co., Inc., and the Citizen's Coal Co., produced coal at Breese.

Coles.—Olen Humphres stone quarry, Ashmore, and Langs stone quarry, Charleston, produced limestone for riprap, concrete aggregate, roadstone, railroad ballast, agricultural use, and fertilizer. Martin's Sand & Gravel, Charleston, dredged sand and gravel from a wet pit; Verling Pinnell, Ashmore, produced road gravel.

Cook.—Cook County ranked fifth in value of mineral production in Illinois in 1954. Limestone and dolomite were produced by Consumers Co. and Dolese & Shepard Co., both of Chicago. Materials Service Corp. operated six quarries at Lyons. The output was used for refractories, concrete aggregate, roadstone, railroad ballast, asphalt, flux, rock dust, and soil conditioner and for fillers. Standard Lime & Stone Co., LaGrange, and Marblehead Lime Co., South Chicago and Thornton, produced lime for building, chemical, industrial, and refractory purposes. There were four producers of miscellaneous clay used for manufacturing heavy clay products: Carey Brick Co., Chicago Brick Co., and Illinois Brick Co., all of Chicago; and Tuthill Building Materials Co., Riverdale. Chicago Gravel Co., Chicago, produced sand and gravel from pits near Elgin. Output was used in building and road construction, railroad ballast, and other purposes. Expanded perlite for plaster and concrete aggregate was manufactured, from crude material from Southwestern States by the American Bildrok Co. and Silbrico Corp., both of Chicago. Exfoliated vermiculite was produced by the Zonolite Co. from crude material obtained in Western States.

Crawford.—Bowman's gravel pit, Palestine, pumped road gravel from a wet pit. William J. Wyke, Robinson, operated a dredge at Hutsonville, producing sand and gravel for building and road construction.

Cumberland.—A. B. C. Gravel Co. and Spence gravel pit, both of Greenup, produced sand and gravel for building and road uses.

De Kalb.—Sand and gravel for building and road uses was produced

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by Kirkland gravel yard, Kirkland; Elmer Larson, Inc., De Kalb; and Donald Tyrell, Sycamore.

De Witt.—Oscar Fortune, Kenney, and H. M. Rickgauer, Clinton, produced road gravel. The State highway commission contracted for road gravel.

Douglas.—Bell & Zoller Coal Co. operated the Murdock mine at Murdock. The State highway commission contracted for road gravel.

DuPage.—Elmhurst-Chicago Stone Co., Elmhurst, produced limestone for concrete aggregate, roadstone, railroad ballast, and agricultural use. Elmhurst-Chicago Stone Co., Elmhurst, operated sand and gravel pits near Winfield. John Purnel, West Chicago, and Henry Van Acker, Wayne, also produced sand and gravel. Output was used for building construction and highway purposes.

Edwards.—Albion Brick Co., Albion, produced miscellaneous clay for use in manufacturing heavy clay products.

Effingham.—Limestone for concrete aggregate, roadstone, and agricultural use was reported by Winters stone quarry, Altamon. The State highway commission contracted for road gravel.

Fayette.—Burtschi Sand & Gravel Co. and George F. Weaver, both of Vandalia, produced sand and gravel for building and highway use. Mulberry Grove Sand Co., Mulberry Grove, produced foundry sand. St. Elmo Brick & Tile Co., St. Elmo, produced clay for use in manufacturing heavy clay products.

Ford.—W. V. Williams, Gibson City, produced gravel for building and highway use. The State highway commission contracted for sand.

Franklin.—Franklin County was the fourth largest coal-producing area in the State and sixth in value of mineral production. Mineral production consisted entirely of coal. Chicago, Wilmington & Franklin Coal Co., operated the Orient No. 1 mine at Orient and the Orient No. 2 mine at West Frankfort. Old Ben Coal Corp. operated the No. 9 and No. 15 mines at West Frankfort, the No. 14 mine at Buckner, and the No. 22 mine at Valier.

Fulton.—Fulton County ranked third in the production of coal and fourth in value of mineral production. Leading producers were the Traux-Traer Coal Co. Red Ember mine at Fiatt; the United Electric Coal Co. No. 9 mine at Cuba and Buckheart No. 17 mine at Canton; the Little Sister Coal Corp. at St. Daniel; Fairview Collieries Co. Flamingo mine at Fairview; Key Coal Co. at Astoria; the Morgan Mines, Inc., Morgan-Bryant mine at Lewistown; Eblen Bros. Coal Co. No. 1 mine at Canton; and Pschirrer Coal Co. No. 3 mine at Canton. Eighteen other mines produced for the local market. Principal producers were Bruketta & Sons Coal Co., Lewistown Lump Coal Co., Cuba; Pine Bluff Coal Co., Lewistown; and Lingenfelter Coal Co., Canton.

Liverpool Materials Co., Canton, dredged sand and gravel from a wet pit near Liverpool. Output was used for building construction and highway purposes. The Mason County Highway Department and the State highway commission contracted for road gravel. R. D. Chipman, Farmington, produced limestone for agricultural use.

Gallatin.—Seven mines produced bituminous coal. Those producing over 1,000 tons were: B. & W. Coal Co. and Oak Hill Coal

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Co., Junction; Pekin Coal Co., Equality; Sun Valley Coal Co., Eldorado; and Sawnee Coal Co., Harrisburg. Miller Sand & Gravel Co., Carmi, pumped gravel from the Wabash River for paving and road use. The State highway commission contracted for sand and gravel.

Greene.—Fire clay was produced in Greene County by Lyndall W. Wyatt, White Hall, for firebrick and block. Chester Castleberry, White Hall, and Martin Volstad, Carrollton, produced limestone for concrete aggregate, roadstone, railroad ballast and agriculture. Birch Creek Coal Co. produced coal at Roodhouse.

Grundy.—Mines and quarries in Grundy County yielded fire clay, coal, and sand and gravel. Clays, which were utilized for refractory and heavy clay products, were produced by Illinois Clay Products, Joliet. Material Service Corp., Chicago, dredged building sand from a pit near Morris. No. 3 Coal Corp., South Wilmington, and Morris Coal & Mining Co., Morris, produced bituminous coal.

Hancock.—The Gray Quarries (Hamilton), W. F. Hanna (Nauvoo), and R. L. O'Neal & Sons (Carthage) quarried limstone for riprap, concrete aggregate, roadstone, and agricultural use. Triple S mines, Augusta, produced bituminous coal.

Hardin.—Hardin County continued to be the Nation's leading producer of fluorspar, although production and shipments declined sharply. Aluminum Co. of America operated the Fairview and Hamp mines, and the Rosiclare Mill produced Acid-Grade fluorspar. Several properties were explored by drilling. Minerva Oil Co. operated the Crystal and Minerva No. 1 mines and mills. At the Crystal mill the heavy-medium separation (HMS) and flotation plants operated intermittently. A second jaw crusher and a crude storage bin were installed at the HMS plant. Four new cells and a bagging machine were added to the flotation plant. Underground truck roads were extended to old workings and connected with the surface by truck adits. The Minerva No. 1 mill operated about 60 percent of the year. A bagged-product storage warehouse was built at Junction to facilitate shipping. Underground a drilling jumbo was placed in service and a 1,400-foot belt conveyor installed. Ozark-Mahoning Co. worked the Mahoning group, Deardorff, East Green, and North Green mines and treated ore at its Rosiclare mill. Rosiclare Lead & Fluorspar Mining Co. operated the Rosiclare and North Boundary mines and the Rosiclare mill; Mackey-Humm Fluorspar Mining Co. operated the Mackey-Humm mine and mill. Twenty-three other producers reported production, including A. H. Stacey & Sons, at the Victory; Goose Creek Mining Co.; Frazer & Hettiger, at the Hillside; C. C. Mackey at Golconda and Tamar Mining Co. Lead, silver, and zinc in fluorspar ores were recovered as byproducts. Principal producers were Ozark-Mahoning Co., Minerva Oil Co., and Aluminum Co. of America.

J. L. Bean Stone Co. and P. R. Brown Stone Co., both of Golconda, Okerson Quarry Co., and Rigsby & Barnard both of Cave-In Rock, and the Acme Quarries quarried limestone for concrete aggregate, roadstone, and agricultural use.

Henderson.—Limestone was produced by H. B. Graham Quarry Co., Gladstone; Olson Bros., Dallas City; and Galbraith stone quarry,

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Raritan. The rock was used for riprap, concrete aggregate, roadstone, and agriculture.

Henry.—Collinson Bros. and Oberlander Sand Co., both of Moline, operated sand and gravel pits near Kewanee and Colona. Schadt Service Co., Silvis, also produced sand and gravel. Molding sand and sand and gravel for building construction and highway use were produced. Alpha Coal Co. and Alpha and Jim Mines, Inc., Coal Valley, produced bituminous coal.

Jackson.—The Truax-Traer Coal Co., No. 1 Drift mine, and the No. 1 Strip mine at Elkville were active; Joliana Coal Mining Co., which was changed to Elk Coal Co., also mined coal at Elkville; Co-op Coal Co. operated the No. 1 mine at Carbondale. Joe P. Cooksey Coal Co. (Marion), Phillips Coal Co. (Carbondale), and Jess R. Morgan Coal Co. (Ava) operated local mines.

Limestone for concrete aggregate, roadstone, and agricultural use was produced by Illinois Quarry Co., Ava.

Jefferson.—Chicago, Wilmington & Franklin Coal Co., operated the No. 3 mine at Waltonville.

Jersey.—Jersey Quarry, Inc., and Sievers Bros., Fieldon, produced limestone for concrete aggregate, roadstone, and agricultural use. The Jersey County Highway Department contracted for road gravel.

Jo Daviess.—Lead and zinc remained the principal mineral products of Jo Daviess County. Tri-State Zinc, Inc., operated the Bautsch and Luning mine and its combination gravity-flotation mill; Eagle-Pitcher Co. operated the Graham mine and mill; Little Giant Mining Co. worked the Little Giant mine, and Hickory Hill Mining Co. mined the Herman Smith mine. W. E. Broege produced agricultural limestone and Elmer G. Wienen & Sons limestone for use as rubble and roadstone, and in agriculture.

Johnson.—The Charles Stone Co., operating two quarries at Cypress, and Southern Illinois Stone Co., Buncombe, produced limestone for concrete aggregate, roadstone, railroad ballast, and agricultural use.

Kane.—Fox River Stone Co., Elgin, produced limestone for rough construction, rubble, flagging, flux, concrete aggregate, roadstone, and agriculture. Sand and gravel was produced by H. D. Conkey & Co., Mendota; Fox Valley Gravel Co., and Warren T. Sellen, Aurora; Edwin W. Gordon-Steffan & Ethal, Carpentersville; Krahn Gravel Co., Dundee; Material Service Corp. of Chicago, Elgin; Raymond Sand & Gravel, Big Rock; and the Kane County Highway Department. Most of the material produced was used in building and road construction. Geo. B. Smith Chemical Works, Inc., Maple Park, manufactured finished iron oxide pigments from crude material produced in Missouri.

Kankakee.—Northern Illinois Coal Corp. operated the No. 14 mine at Wilmington. Lehigh Stone Co. (Kankakee), Manteno Limestone Co. (Manteno), and Boubonnais Stone Quarry (Bradley) produced limestone for rubble, house-stone veneer, flagging, concrete aggregate, roadstone, railroad ballast, and agricultural use. Eastern Illinois Clay Co., Kankakee Clay Products Co., and St. Anne Brick & Tile Co., all near St. Anne, produced miscellaneous clay for manufacturing heavy clay products. Portage-Manley Sand Co., Rockton, produced molding sand near Essex.

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Kendall.—Central Limestone Co., Morris, produced limestone for flux, concrete aggregate, roadstone, and agricultural use. Elmer Larson, Inc., De Kalb, produced building and road sand and gravel at Plane. The Kendall County Highway Department produced road gravel.

Knox.—Midland Electric Coal Corp. operated the Rapatee Strip No. 1 and the Middlegrove Strip No. 2 at Farmington. Stonefort Coal Corp. operated the Little John at Victoria; Little Coal Co. mined at Farmington, and Knoxville Mining Co. worked the No. 2 mine at Galesburg. Clay was mined by Purington Brick & Tile Co., Galesburg, for manufacturing heavy clay products. L. K. Bandy Construction Co., Maquon, produced fill sand and road gravel near London Mills.

Lake.—Clay for manufacturing heavy clay products was mined by National Brick Co., Deerfield. Perlite from Western States was expanded by Lake Zurich Concrete Products Co., Lake Zurich, for use as lightweight plaster and concrete aggregate. Sand and gravel, for building and road construction, was produced by B & J Sand & Gravel, Spring Grove; Carl L. Barthel, Antioch; Big Hollow Sand & Gravel Co., Inc., Ingleside; Consumers Co., of Chicago, Wadsworth; Paul W. Schumaker, Gurnee; Marvin Walker, Lake Villa; and the Lake County Highway Department. The State highway commission produced road gravel. Johns-Mansville Corp. produced magnesium carbonate from dolomite for use as insulation.

La Salle.—La Salle County ranked first in Illinois in 1954 in the production of mineral commodities. The mines and quarries of the county produced sand and gravel, portland cement, clays, stone, and bituminous coal. The major mineral product was portland cement from the plants of Alpha Portland Cement Co., La Salle, and Lehigh Portland Cement Co. and Marquette Cement Manufacturing Co., both of Oglesby. La Salle County produced over 3 million tons of sand and gravel for use as glass, molding, blast, furnace, filter, engine, grinding, and polishing sands, as well as building and paving sand and gravel. Leading producers include American Silica Sand Co., Inc., Ottawa Silica Co., and Standard Silica Corp., all of Ottawa; Moline Consumers Co., of Moline, at Ottawa and Sheridan; and Wedron Silica Co., of Chicago, at Wedron. Conco-Meier Co., Lowell, Laclede-Christy Co., Ottawa, Arthur Mart, Streator, and Matthiessen & Hegeler Zinc Co., La Salle, produced fire clay for manufacturing firebrick and block, mortar, zinc retorts, and heavy clay products. Miscellaneous clay was produced by Monmouth Stone Co., Lowell, and Streator Drain Tile Co., Streator, for manufacturing heavy clay products. Limestone was produced by Sheridan Stone Co. (Sheridan), Troy Grove Stone Co. (Ottawa), and Utica Stone Co. (Spring Valley) for railroad ballast, concrete aggregate, roadstone, lime, and agriculture.

French Creek Coal Co., Andrew Kollar Coal Co., and Arthur Mart Coal Co. (all of Streator), E. Roy Meyers Coal Co. (Ottawa), Monmouth Stone Co. (La Salle), and Lawrence Donavan Coal Co. (Utica) produced coal for local consumption. Chicago Retort & Fire Brick Co. produced coal at Ottawa for its own consumption.

Lawrence.—Gregory Gravel Co., Lawrenceville, pumped building and paving sand and gravel from a wet pit. The Lawrence Highway

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Department and the State highway commission contracted for sand and gravel.

Lee.—Medusa Portland Cement Co. operated a cement plant near Dixon. Sand and gravel for building and paving use was produced by Butler Sand & Gravel, Inc., Nelson; C. C. Macklin, Stewart; and Rock River Ready Mix, Dixon. Frank N. Butler Co., Stoneridge Limestone Co., Wilmer Gerdes Quarry, and Ward McGinnis produced limestone for concrete aggregate, roadstone, and agricultural use.

Livingston.—Limestone was produced by 4 companies operating 5 quarries in Pontiac. These were, in order of declining output, Pontiac Stone Co. (two quarries), Livingston Stone Co., Inc., Ocoya Stone Co., and Wagner Stone Co. The output was used for concrete aggregate, roadstone, agricultural purposes, and asphalt. Miscellaneous clay was produced for manufacturing heavy clay products by Diller Tile Co., Chatsworth, and Streator Brick Co. Division, Streator. Road gravel was produced by Estep Gravel Co., Fairbury, and Valley View Dirt & Gravel Co., Manville. Streator Drain Tile Co. and Baiett and Talbot Coal Co., both of Streator, produced coal for local consumption.

Logan.—Lincoln Sand & Gravel Co., Lincoln, produced sand and gravel for building and paving material and for engine sand. Lime stone and dolomite for concrete aggregate, roadstone, and agricultural purposes were produced by Rocky Ford Limestone Co., Lincoln. Deer Creek Coal Co., Lincoln, produced coal for local consumption.

Macon.—Sand and gravel for construction and road use was produced by Decatur Sand & Gravel Co., Decatur. Road gravel was produced by Kirt's gravel pit and F. C. Troutman, Decatur, and H. M. Rickgauer, Clinton. The State highway commission contracted for road gravel.

Macoupin.—International Vermiculite Co., Girard, expanded crude vermiculite from Western States for use in high-temperature block, insulation, cement, pipe covering, and industrial loose fill. Bituminous coal was produced by Little Dog Coal Co. and Superior Coal Co., both at Gillespee, and Virden Mining Corp., Virden.

Madison.—Limestone and dolomite were quarried for riprap, flagging, concrete aggregate, roadstone, soil conditioner, filler, pottery, asphalt, rock dust, mineral food, and chemical use by C. M. Lohr, Inc., Godfrey, and Mississippi Lime Co. of Missouri and Reliance Whiting Co., both of Alton. Fire and miscellaneous clay for manufacturing heavy clay products were mined by Alton Brick Co., North Alton. Gary Dredging Co. and the Mississippi Lime Co. of Missouri, both of Alton, dredged sand from the Mississippi River. Stocker Gravel & Construction Co., Highland, and Thompson Asphalt Co., Madison, produced sand and gravel for building construction and road purposes. Engine sand and sand for miscellaneous uses also were produced. The State highway commission contracted for sand and gravel. Bituminous coal was produced by Livingston-Mt. Olive Coal Co., Livingston; Mt. Olive & Staunton Coal Co., Staunton; and Lumaghi Coal Co., and Bluff Coal Co., both at Collinsville.

Marion.—Marion County Coal Mining Corp., operated the Glenridge mine at Centralia.

Marshall.—Consumers Co., of Chicago, Ill., produced sand and gravel for building and paving use at Lacon. Vernon Henry pro-

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duced road gravel at La Rose. The Peoria pit of Hydraulic-Press Brick Co., yielded miscellaneous clay for use in manufacturing heavy clay products.

McDonough.—John McClure and John McClune, Colchester, and Phillip Lewis & Son, Macomb, produced limestone for concrete aggregate, roadstone, and agriculture. Baird clay mines, Frank Nelson, J. R. Purtscher, and Western Stoneware Co., all of Colchester, produced fire and miscellaneous clay for art pottery, stoneware, and heavy clay products.

McHenry.—McHenry County ranked second in Illinois in the production of sand and gravel. Consumers Co. of Chicago (at Algonquin and Crystal Lake), Crystal Lake Trucking & Excavating Co. of Crystal Lake (at Cary), Floyd M. Griebel (Marengo), Grove Gravel & Excavating Co. (Fox River Grove), McHenry Sand & Gravel Co., Inc., and Tonyan Bros. (both at McHenry), and Wayne Nolan (Harvard) produced sand and gravel for building and road construction. Garden Prairie Stone Co., Inc., Marengo, produced limestone for flagging, concrete aggregate, roadstone, and agriculture.

McLean.—Road gravel was produced by John Howes and Rowe Construction Co., both of Bloomington. McGrath Sand & Gravel Co., Inc., Lincoln, produced sand and gravel near Bloomington for building and paving use.

Menard.—Limestone for concrete aggregate, roadstone, and agricultural use was produced by Athens stone quarry, Athens. Heavy clay products were manufactured from clay mined by Springfield Clay Products Co., Petersburg. Bituminous coal for local consumption was mined by Indian Creek Coal Co., Wilcox-Verna Coal Co., and Forden Coal Co., all of Petersburg; Greenview Fuel Co., Greenview; and Lloyd coal mine at Tallula.

Mercer.—Independent Materials Co. produced limestone for use as concrete aggregate and roadstone from its quarry at Viola. Miscellaneous clay was produced from pits of the Hydraulic-Press Brick Co., Shale City.

Monroe.—Columbia Quarry Co. produced crushed and broken limestone for riprap, open-hearth and smelter flux, concrete aggregate, roadstone, agricultural use, coal-mine dust, and other uses.

Montgomery.—Limestone for concrete aggregate, roadstone, and agricultural use was produced by Litchfield Stone Co., Litchfield. Freeman Coal Mining Corp. operated the Crown mine at Farmersville. Sand and gravel was produced by the County highway department, and the State highway commission contracted for road gravel.

Ogle.—Engine sand and sand and gravel for building use, highway construction, and railroad ballast were produced by Byron Sand & Stone Co., Byron; E. C. Kolpek, Oregon; Kutz Bros. Co., Forreston; McGrath Sand & Gravel Co., Inc., of Lincoln at Forreston; Rockford Blacktop Construction Co., Rockford; Schilling's Gravel Pit of Milledgeville at Hazelhurst; Floyd Weigle of Shannon at Forreston; and the Leaf River Township Highway Department. The Ogle County Highway Department and the State highway commission contracted for sand and gravel. Kutz Bros. Co. (Forreston), Clarence Lenstrom (Stillman Valley), William Seitz and Charles D. Willrett (Malta), and Ogle County produced limestone for rough construction, concrete aggregate, roadstone, and agstone.

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Peoria.—Sand and gravel was produced for building and highway use, railroad ballast, and fill by Chillicothe Gravel Co. and Construction Materials Co., both of Chillicothe; Coogan Gravel Co., Stever, Inc., and Charles L. Swords & Son, all of Peoria; McGrath Sand & Gravel Co., Inc., of Lincoln, at Chillicothe; and the Chicago Rock Island & Pacific Railroad. The city of Peoria and the Woodford County Highway Department contracted for sand and gravel. Limestone and dolomite for concrete aggregate, roadstone, agricultural use, fertilizer, and filler were quarried by Lamar Stone Co., Princeville, and Trivoli Stone Co., Trivoli. Sixteen mines produced bituminous coal, mostly for local consumption. The principal producers were Morgan Coal Co., Edwards; J. & J. Coal Co., operating 2 mines at Canton; Pioneer Collieries Co., Laura, and Zaborac Coal Co., Peoria.

Perry.—Bituminous coal was produced at Pinckneyville by Truax-Traer Coal Co. from the Pyramid and No. 2 strip mines and Service Coal Co. from the No. 6 mine. At Du Quoin, Peabody Coal Co. operated the No. 14 mine. The United Electric Coal Co. No. 11 mine and Union Colliery Co. New Kathleen mine were active. Big Five Coal Co. worked its mine at Conant and Cutler Coal Co., Inc., operated at Cutler. Elm Grove Coal Co. (Cutler), Gem Coal Co. (Pinckneyville), and Du Quoin Coal Co. (Du Quoin), produced coal for local consumption. Perry County ranked eighth in value of mineral production.

Pike.—Missouri Gravel Co., Moline, operated a pit at Barry to produce sand and gravel for road use and railroad ballast. Victor Callender, Pittsfield, produced road gravel. The State highway commission contracted for gravel. Limestone for concrete aggregate, roadstone, and agricultural use was quarried by Harry Junior Lacy and Pearl Stone Co., Pearl, and Narvin O. Lumley, Kinderhook.

Pope.—Fluorspar was produced by the Hicks Creek Fluorspar Co., and P. M. T. Mining Co. at the Douglas mine and Egyptian Mining Co. at the Empire. Wiley Cochran and Ray Stone reported production. Crude ore produced was processed by mills in Hardin County and in Kentucky. The Pope County Highway Department, Golconda, produced road gravel.

Pulaski.—Columbia Quarry Co. quarried limestone for use as riprap, refractories, railroad ballast, and agstone. Miscellaneous clay for absorbent uses was produced by American Charcoal Co.

Randolph.—Limestone was produced for alkali, riprap, concrete aggregate, roadstone, and agricultural use by the Allied Chemical & Dye Corp. and Al Stotz, Waterloo; Chester Quarry Co., Chester; and Randolph County. Southern Illinois Sand Co., Inc., Chester, dredged sand from the Mississippi River for use in building, paving, filters, engine sand, and fill.

Bituminous coal was produced by Southwestern Illinois Coal Corp. and Crain Co., Inc., both at Percy. Moffat Coal Co., Midwest Utilities Coal Corp., Ritter Coal Co., and West Side Coal Co. produced coal at Sparta.

Rock Island.—Limestone for use as riprap, concrete aggregate, roadstone, railroad ballast, quarry rock, and agstone was produced by Collinson Stone Co. and Midway Stone Co., Inc., Geneseo, and Cordova Quarry, Inc., Moline. Blackhawk Aggregates, Inc., Milan, and

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Builders Sand & Gravel Co. produced sand and gravel for building, paving, and fill. The State highway commission contracted for sand and gravel. Blackhawk Clay Products Co. produced fire clay for miscellaneous uses.

St. Clair.—In 1954 St. Clair County ranked seventh in Illinois in the value of mineral production. Lime for building, chemical, and industrial purposes was produced by Aluminum Co. of America. Clay for heavy clay products was produced by Hill Brick Co. and Hydraulic-Press Brick Co., both of Edgemont. The mines and quarries of the county yielded dimension limestone for use as rubble, rough architectural blocks, and flagging. Crushed and broken limestone was used as riprap, concrete aggregate, roadstone, railroad ballast, agstone, filter beds, and stone sand. Stone producers were Columbia Quarry Co., East St. Louis Stone Co. and Casper Stolle Quarry & Construction Co., both of East St. Louis; and Hecker Quarry, Inc., New Athens. Building, paving, engine, and filter sands were mined by Missouri-Illinois Materials Co., St. Louis, Mo.

Coal was mined at the Seminole Coal Corp. strip pit 17 at Lenzburg and the Mid-Continent Coal Corp. Green Diamond mine and New West Side Coal Co. No. 1087, both at Marissa; Perry Coal Co. St. Ellen mine, at O'Fallon; St. Louis & O'Fallon Coal Co. Black Eagle No. 2 at Belleville; and the Morgan Mines, Inc. Wolz Baltz pits at Millstadt. Ten local mines were operated, the most important being Midwest Radient Corp. at Millstadt and Belle Valley Coal Co. at Belleville. C. K. Williams & Co., East St. Louis, manufactured iron oxide pigments for bog ore produced in Colorado.

Saline.—Bituminous coal was produced by Sahara Coal Co., Inc., from four mines at Harrisburg and Peabody Coal Co. from mines at Harrisburg and Galatia. Saxton Coal Corp. operated the New Castle No. 2 at Carrier Mills, and Williams Coal Co., at Harribsurg. Four local mines also produced coal. The county ranked ninth in Illinois in value of mineral production.

Sangamon.—Clay was produced by Poston Brick & Concrete Products Co., and Springfield Clay Products Co., both of Springfield, for the manufacture of heavy clay products and lightweight aggregates. Buckhart Sand & Gravel Co., Inc. (Mechanicsburg), and Clear Lake Sand & Gravel Co. and Springfield Sand & Gravel Co. (both of Springfield) produced sand and gravel for building, paving, and fill. Eddy Coal Co. (Cantrall), Farrand Coal Co. (Riverton), Cantrall Coal Co. (Springfield), and Wenneborg Coal Co. (Sherman) produced coal for local consumption.

Schuyler.—Lyle B. Moushon, Carrollton, produced road gravel. Green Coal Co. (Camden) and Wheelhouse Coal Co., A. H. McCormick & Sons, and D. & D. Coal Co. (all of Rushville) produced coal for local consumption.

Scott.—Crushed and broken limestone was produced by Krueger quarry and Thomas quarry, Winchester, for concrete aggregate, roadstone, and agricultural uses. Homer E. Grady, Exeter, produced gravel for backfill.

Shelby.—Hanfland Sand & Gravel Co., Shelbyville, produced sand and gravel for building and paving use. Corley Gravel (Cowden) and Henry Cummings (Sullivan) mined road gravel. The Shelby County Highway Department contracted for road gravel.

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Stephenson.—Limestone was produced for concrete aggregate, roadstone, and agstone by Ray Askey (Orangeville), W. E. Broege (Warren), Ed. Finkbiener & Son (Freeport), Arthur Zimmerman (Pecatonica), and Stephenson County. West Point Township produced road gravel, and the State highway commission contracted for road gravel.

Tazewell.—Torpedo sand, engine sand, and sand and gravel for railroad ballast, building construction, and paving were produced by Hoffer Construction Co., Inc., East Peoria; McGrath Sand & Gravel Co., Inc., of Lincoln, at Mackinaw and Pekin; and C. A. Powley, Washington. The Mason County Highway Department and the State Highway Commission contracted for road gravel. Minito Filler Co., Peoria, produced peat in Tazewell County for use as humus. Clay was mined by Peoria Brick & Tile Co. from its pit at East Peoria for manufacturing heavy clay products. Lakeside Coal Co., Pekin, produced coal for local consumption.

Union.—Limestone for riprap, concrete aggregate, roadstone, agstone, asphalt, and filter beds was produced by Anna Quarries, Anna, and Jonesboro Stone Co., Waldo. Bittle & Emrick, Anna, produced paving sand.

Vermilion.—Western Brick Co. and General Refractories Co., both with pits at Danville, produced clays for use in manufacturing firebrick and block and heavy clay products. Sand for building use and gravel for building and paving was produced by Blakeney Gravel Pit, Lewis & Co., and Elton A. Wagner Co., all of Danville, and Jesse Speranza and Vanderpoorten gravel pit, Westville. Fairview Collieries Corp., operating the Harmattan, V-Day Coal Co., and Two Rivers Coal Co., all of Danville, produced bituminous coal. Eight local mines produced coal for local consumption.

Wabash.—Sand and gravel for building, paving, and railroad ballast was produced by Mt. Carmel Sand & Gravel Co. (Mount Carmel), Allendale Gravel Co. (Allendale), and Dunbar Sand & Gravel Co. (Bellmont), at Cowling.

Warren.—Crushed and broken limestone for use as riprap, concrete aggregate, roadstone, and agriculture was produced by Monmouth Stone Co., Monmouth. Miller Bros. Coal Co., Mathersville, produced coal.

Washington.—Bois Coal Co., Dubois, and Venedy Coal Co., Inc., Venedy, produced bituminous coal for local consumption.

White.—Building and paving sand and gravel was produced by Eastwood Sand & Gravel, Grayville, and Frashier Bros. Sand & Gravel and Miller Sand & Gravel Co., Maunie. The State highway commission contracted for sand and gravel.

Whiteside.—Crushed and broken limestone was produced for riprap, concrete aggregate, roadstone, and agricultural use by Fred R. McKenzie, Galesburg. Building and paving sand and gravel was produced by Anderson Ready Mix, Rock Falls; Ernest Johnson and Vohn & Toppert, Lyndon; Max Lawrence, Weldon W. Lawrence, and H. J. Tabor & Sons, all of Prophetstown; Midwest Sand & Gravel Co., and Vernon Schrader Gravel, both of Sterling; and Hume and Jordon Townships. Contracts for sand were placed by the State highway commission and Mount Carroll Township and for gravel by Prophetstown Township.

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Will.—Will County ranked second in Illinois in the production of sand and gravel and fifth in the production of stone. Sand and gravel for building, paving, railroad ballast, and fill was produced by Avery Gravel Co., Plainfield; Chicago Gravel Co., of Chicago, at Plainfield and Joliet; Materials Service Corp., of Chicago, at Plainfield; and C. H. Monk, Joliet. Stone quarries in the county yielded flux, concrete aggregate, roadstone, railroad ballast, agricultural limestone, and regrinding stone. These limestone quarries were operated by Will County and by Lincoln Stone Co. and National Stone Co., both of Joliet. Liquid and elemental sulfur was recovered by Globe Oil & Refining Co. Perlite from Western States was expanded by F. E. Schundler & Co., Inc., Joliet, for use as lightweight aggregate in plaster and cement. Vermiculite from Western States was exfoliated for use in house fill, lightweight plaster and concrete aggregates, cement, and block insulation by F. E. Schundler Co., Inc. Wilmington Coal Mining Corp., Braidwood, produced bituminous coal.

Williamson.—Williamson County ranked first among the coal-producing counties of Illinois and second in value of mineral production. Shipping mines were Delta Collieries Corp., Freeburn Mining Co., Carmac Coal Co., Freeman Coal Mining Corp., Strobel Coal Co., C. & C. Coal Co., New Black Crystal Coal Co., Harrisburg Coal Co., Wilkins Coal Co., Pure Coal Co., and New Black Diamond Coal Co., all of Marion; Bell & Zoller Coal Co., Johnston City; Forsyth-Carterville Coal Co., Carterville; Bell & Zoller Coal Co., Zeigler; Blue Bird Coal Co., operating two mines at Harrisburg; Morgan Mines, Inc., Herrin; and Stonefort Corp., Stonefort, operating the Will Scarlet. Twelve mines produced coal for local consumption. The principal producers were Barbara Kay Coal Co. and Moore & Son Coal Co., both of Marion.

Limestone for riprap, concrete aggregate, roadstone, and agricultural use was produced by Williamson County.

Winnebago.—Engine and filter sand and sand and gravel for building, paving and railroad ballast were produced by Anderson Sand & Gravel Co., Larson Bros. Sand & Gravel, and Sahlstrom & Sons Building Products, all of Rockford; Consumers Co., Illinois-Wisconsin Sand & Gravel Co., and South Beloit Sand Co., all near South Beloit; Kelley Sand & Gravel and Porter Bros., both of Roscoe; and Northwest Gravel Co., of Evanston, at South Beloit. The State highway commission contracted for road gravel. Crushed and broken limestone was produced by Charles Ind. Co., operator of Byrnes & Mulford quarries, and William Nordhop, both of Rockford; Porter Bros., operator of Graves & Porter quarries, Roscoe; and Arthur Zimmerman, operator of Maslucola & Eaton quarries, Pecatonica.

Woodford.—John Keller & Sons produced gravel for building and paving at Eureka. The Woodford County Highway Department contracted for road gravel.

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The Mineral Industry of Indiana

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Geological Survey, Indiana Department of Conservation.

By Donald F. Klyce [1] and John B. Patton [2]

MINERAL production in Indiana in 1954 declined 3 percent from 1953. Increased production of cement, sand and gravel, and stone failed to offset reduction in the output of coal and petroleum. Production of 13 mineral commodities was reported. Deposits of gypsum in Martin County were being developed, with production scheduled for the following year.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences of coverage.

TABLE 1.—Mineral production in Indiana, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	1,654,112	$2,514,227	1,946,069	$2,990,716
Coal	15,812,485	62,353,519	13,400,188	48,913,455
Marl, calcareous	13,540	6,398	28,536	18,515
Natural gas, million cubic feet	701	49,000	735	44,000
Peat	6,919	41,049	12,041	59,149
Petroleum (crude), thousand 42-gallon barrels	[2] 12,823	[2] 37,570,000	[3] 11,204	[3] 33,160,000
Sand and gravel	11,203,059	9,500,914	14,405,098	11,879,316
Stone (except limestone for cement and lime, 1953)	9,212,887	22,297,183	11,181,838	27,460,119
Undistributed: Abrasives (whetstones), cement, lime, pyrites, and recovered sulfur. Excludes value of clay for cement (1953)		35,448,379		42,388,935
Total Indiana		169,781,000		[4] 165,369,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Final figure. Supersedes preliminary figure in commodity chapter.
[3] Preliminary.
[4] Total has been adjusted to eliminate duplication of value of clays and stone.

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REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—In 1954 coal continued to be Indiana's principal mineral commodity, with a valuation of slightly less than $50 million. Production was estimated to be about 15 percent less than in 1953.

The major producing areas were in the southwestern part of the State in Vigo, Pike, Sullivan, Knox, and Warrick Counties.

Mechanization of Indiana coal mines was extended during 1954 with the purchase of 1 mobile loading machine, 2 shuttle cars, and 2 "mother" conveyors.[3]

Construction progressed on the large steam-generating units near Madison in Jefferson County. Output will be used by the Portsmouth, Ohio, plant of the Atomic Energy Commission. By the end of the year some of the units were in limited production. When full production is realized, over 4 million tons of coal annually will be required for operation of the generators. Fuel demands will be met chiefly by barging coal up the Ohio River from mines in Warrick County, Ind., and adjacent areas in Kentucky.

The Bureau of Mines studied the results of an intensive dust-sampling survey of an Indiana coal mine with special samples from several Pennsylvania coal mines and discussed related studies in the Bureau's Experimental coal mine.[4]

Peat.—The value of peat production in Indiana in 1954 increased 44 percent over 1953. Eight sources reported production from late Pleistocene bogs in the following counties: Blackford, DeKalb, Grant, Hamilton, Marion, Steuben, and Wells. Moss peat composes three-quarters of the output, and humus and reed peat made up the remainder. The principal use was as a soil conditioner.

TABLE 2.—Production of peat, 1947–54

Year	Number of producers reporting	Short tons	Value	Year	Number of producers reporting	Short tons	Value
1947	3	3,957	$14,760	1951	5	5,699	$22,824
1948	3	2,288	11,576	1952	9	10,115	49,775
1949	7	7,949	28,537	1953	6	6,919	41,049
1950	5	5,793	18,966	1954	8	12,041	59,149

Petroleum and Natural Gas.—About three-fourths of Indiana oil production came from Mississippian rocks. Most was from upper Mississippian sandstones, and the remainder from middle Mississippian limestones. About one-seventh of the State production was from Pennsylvanian sandstones, and about one-tenth from Devonian dolomite and limestone. The Trenton limestone (Ordovician) produced a small quantity of oil from one field in south-central Indiana and from the large but nearly depleted Trenton field in northeast-central Indiana.

Petroleum production in Indiana in 1954 was 13 percent less than in 1953, and natural-gas production increased 5 percent over the previous year.

[3] Coal Age, February 1956, pp. 75–76.

[4] Hartmann, Irving, Nagy, John, Rauschenberger, J. K., Lessons from Intensive Dust Samplings of a Coal Mine: Bureau of Mines Rept. of Investigations 5054, 1954, 12 pp.

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A total of 927 wells was completed compared with 1,312 in 1953. As in previous years, drilling was concentrated in the southwestern part of the State. Approximately two-thirds of the total was drilled in five southwestern counties: Gibson, Posey, Pike, Dubois, and Spencer. Of the wells drilled, 320 were wildcats, and 607 were for development purposes. Oil was produced from 306 of these new wells and gas from 15; 606 were dry.[5]

The total footage drilled in 1954 was 1,380,000 feet. The average footage drilled per well was 1,556 feet.[6]

Most successful exploratory wells were completed in beds of Mississippian age. Production also came from the Pennsylvanian and Devonian systems.

Oil produced by waterflood operations currently supplies an estimated 15 percent of Indiana's output. Some waterflood projects are being expanded, and others are just being started. Oil produced by waterflood methods will have a sustaining influence on Indiana's production for a number of years.

Reserves of petroleum and natural gas declined in 1954 as production exceeded discoveries and extensions. Estimations indicate that proved reserves totaled 61 million barrels of crude oil and 33 billion cubic feet of natural gas as of January 1, 1955.[7]

TABLE 3.—Production of crude oil, 1954, by major fields [1]

Field	County	Year discovered	Area (acres)	1954 production (barrels)	Number of wells, 1954	
					Producing	Completed
Black River Consolidated	Posey	1950	280	163,038	21	2
Caborn Consolidated	do	1940	1,320	402,377	103	6
Erskine	Vanderburgh	1931	480	182,650	64	0
Fairbanks	Sullivan	1950	420	304,354	19	0
Ford South	Posey	1950	560	189,756	49	0
Griffin Consolidated	Gibson and Posey.	1938	5,870	1,368,584	561	8
Heusler Consolidated	Posey and Vandenburgh.	1938	1,390	146,555	87	0
Martin	do	1947	620	125,089	59	4
Marts	Sullivan	1949	340	146,481	21	0
Monroe City Consolidated	Knox	1950	1,490	199,917	107	2
Mount Carmel Consolidated	Gibson and Knox.	1941	1,660	589,530	161	3
Mount Vernon Consolidated	Posey	1941	1,550	504,095	145	2
Owensville East Consolidated	Gibson	1948	780	131,107	77	0
Owensville North	do	1943	1,670	198,587	96	3
Patoka East	do	1947	660	274,674	56	5
Plainville	Daviess	1950	350	134,074	57	0
Riley South	Vigo	1952	240	123,403	11	0
Rochester	Gibson	1948	420	621,039	42	4
Spencer	Posey	1948	450	138,341	41	0
Springfield Consolidated	do	1946	1,810	378,256	215	3
Terre Haute East	Vigo	1951	380	203,071	18	1
Union-Bowman Consolidated	Gibson, Knox, Pike.	1941	15,950	766,632	395	61
Welborn Consolidated	Posey	1941	1,100	428,552	111	0
West Hovey	do	1944	190	129,829	12	0
Undistributed				3,354,009	1,382	823
Total				11,204,000	3,910	927

[1] Dawson, T. A. and Carpenter, G. L., Oil Development and Production in Indiana During 1954: Indiana Dept. of Conservation, Geol. Survey Min. Econ. Ser. 1; pp. 5-10.

[5] Data from Indiana Department of Conservation, Geological Survey, Indiana University, Bloomington, Ind.
[6] Oil and Gas Journal, Annual Review Issue, Jan. 31, 1955, pp. 149-163, 238, 239.
[7] Work cited in footnote 6.

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NONMETALS

Abrasive Materials.—Natural whetstones were produced from beds of fine-grained Lower Pennsylvanian sandstone by the Indiana Sandstone Co., Inc., at the Hindostan Whetstone quarry in Orange County. This company was the only producer in the State that reported this commodity in 1954.

Cement.—In 1954 the output of portland cement increased about 2 percent. Shipments were nearly 4 percent larger than in 1953, resulting in a 9-percent decrease in stocks by the end of the year 1954. As cement prices increased from $2.57 in 1953 to $2.86 in 1954, the value of portland-cement shipments was nearly one-eighth greater than in the previous year.

Active producers in 1954 were Louisville Cement Co., Inc., Speed (Clark County); Lehigh Portland Cement Co., Mitchell (Lawrence County); Lone Star Cement Corp., Limedale (Putnam County); and Universal Atlas Cement Co., Buffington (Lake County). The first three of these companies used limestone as the chief raw material and shale to furnish most of the alumina and silica content. Universal Atlas Cement Co. used blast-furnace slag obtained locally and high-calcium limestone shipped by Great Lakes freighters from Michigan quarries.

The Louisville Cement Co., Inc., also produced natural cement from the Silver Creek formation near Speed.

Clays.—Production of clays in 1954 increased 18 percent over 1953. Production was reported from 47 clay pits in 27 counties. Fire clay was produced from 16 pits and miscellaneous clay from 33 pits. The principal producing areas were in Clay, Greene, Lake, Martin, and Morgan Counties.

Miscellaneous clay was produced from shales, principally in the lower Mississippian and lower Pennsylvanian, and from glacial materials that include till, lake clays, and alluvial clays. The miscellaneous clay was used in manufacturing heavy clay products (building brick, paving brick, drain tile, sewer tile, and related products) and cement. A new lightweight-aggregate industry, using lower Mississippian shale for bloating, was under development during the year but did not report commercial production. Fire clay, produced from the underclays beneath lower Pennsylvanian coals, was used for firebrick, high-grade tile, refractories, stoneware, and art pottery, as well as for heavy clay products.

TABLE 4.—Clays sold or used by producers, 1945–49 (average) and 1950–54

Year	Fire clay		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	316, 520	$541, 533	704, 648	$553, 966	1, 021, 168	$1, 095, 499
1950	503, 661	801, 118	909, 072	804, 301	1, 412, 733	1, 605, 419
1951	499, 723	821, 672	1, 025, 008	1, 092, 785	1, 524, 731	1, 914, 457
1952	397, 336	732, 025	933, 962	968, 184	1, 331, 298	1, 700, 209
1953	[1] 582, 639	[1] 1, 163, 687	[1] 1, 071, 473	[1] 1, 350, 540	1, 654, 112	2, 514, 227
1954	374, 081	700, 044	1, 571, 988	2, 290, 672	1, 946, 069	2, 990, 716

[1] Revised figure.

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Lime.—A small quantity of quicklime was produced by the Indiana State Farm at Putnamville in Putnam County for its own use. The Louisville Cement Co., Inc., which had operated a limekiln and batch hydrator at Milltown in Harrison County, closed down operations in November 1953.

Marl, Calcareous.—Production of calcareous marl in 1954 more than doubled the 1953 output. The marl came from late Pleistocene lake deposits. Noble County deposits yielded nearly half the State production, with three producers reporting. Output also was reported from Fulton, Marshall, and Wabash Counties. The marl was used for agricultural purposes.

TABLE 5.—Production of calcareous marl, 1949–54

Year	Number of producers reporting	Short tons	Value	Year	Number of producers reporting	Short tons	Value
1949	8	44,026	$49,543	1952	5	16,414	$9,021
1950	6	20,380	13,977	1953	4	13,540	6,398
1951	4	12,960	18,129	1954	6	28,536	18,515

Perlite.—Crude perlite, obtained from Western and Southwestern States, was expanded for use as a lightweight aggregate for plaster and concrete by the Airlite Processing Corp. at Vienna, Scott County.

Sand and Gravel.—Production of sand and gravel in 1954 increased 29 percent over 1953. Reports were received for 249 operations in 72 counties. Nearly all of the output (89 percent) continued to be used for building and paving purposes. Additional production aggregating over 1 million tons was used in industry (molding, engine, glass, and filter sand) and for railroad ballast.

Nearly all of the material was produced from glacio-fluviatile deposits of Wisconsin age; relatively small production came from alluvial deposits in present-day stream channels. Most large operations produce from glacial outwash that occurs as valley fill. There are many smaller operations in eskers or kames. Along and near the south shore of Lake Michigan, ancient beach sands and dune sands of both ancient and modern origin are mined for industrial sand purposes.

The 10 largest producers, who supplied for nearly half the commercial output, included American Aggregates Corp. of Greenville, Ohio, in Marion and Wayne Counties; Bedford-Nugent Co., Inc., Evansville, in Spencer and Vanderburgh Counties; Walter J. Hieb Sand & Gravel, Inc., Louisville, Ky., in Clark County; Koch Sand & Gravel Co., Evansville, in Vanderburgh County; Material Service Corp., Chicago, Ill., in Vermillion County; Neal Gravel Co., Inc., Covington, in Fountain, Vermillion, and Warren Counties; Portage-Manley Sand Co., Rockton, Ill., in LaPorte and Porter Counties; Spickelmier Co., Indianapolis, in Marion County; Standard Materials Corp., Indianapolis, in Marion and Vermillion Counties; and Terre Haute Gravel Co., Terre Haute, in Vigo County.

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TABLE 6.—Sand and gravel, sold or used by producers, 1953–54, by classes of operations and uses

	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Molding	499,290	$672,166	$1.35	468,708	$571,795	$1.22
Building	1,745,960	1,476,207	.85	2,789,461	2,030,637	.73
Paving	2,096,126	1,628,489	.78	2,463,947	1,549,310	.63
Engine	72,087	43,019	.60	76,905	57,480	.75
Other	34,283	10,320	.30	98,808	61,774	.63
Undistributed [1]	293,478	254,455	.87	88,329	54,731	.62
Total commercial sand	4,741,224	4,084,656	.86	5,986,158	4,325,727	.72
Gravel:						
Building	1,735,956	1,667,002	.96	3,175,105	3,139,370	.99
Paving	3,583,081	2,974,015	.83	3,766,901	3,458,007	.92
Railroad ballast	523,815	438,916	.84	415,030	328,692	.79
Other	75,231	54,514	.72	472,052	373,850	.79
Total commercial gravel	5,918,083	5,134,447	.87	7,827,088	7,299,919	.93
Total commercial sand and gravel	10,659,307	9,219,103	.86	13,813,246	11,625,646	.84
GOVERNMENT-AND-CONTRACTOR						
Sand: Paving	131,322	78,803	.60	95,685	74,706	.78
Gravel: Paving	412,430	203,008	.49	496,167	178,964	.36
Total Government-and-contractor sand and gravel	543,752	281,811	.52	591,852	253,670	.43
ALL OPERATIONS						
Sand	4,872,546	4,163,459	.85	6,081,843	4,400,433	.72
Gravel	6,330,513	5,337,455	.84	8,323,255	7,478,883	.90
Grand total	11,203,059	9,500,914	.85	14,405,098	11,879,316	.82

[1] Includes fire and railroad ballast sand (1953); glass and filter sand (1954) to avoid disclosure of individual company operations.

Slag.—Chiefly a byproduct of iron blast-furnace operations, slag was produced by steel companies in the Gary-East Chicago area. Much of the slag was air-cooled, then crushed and sized for aggregate use. Some slag was shipped to mineral-wool companies as raw material for making rock-wool insulation, and some was expanded for use as a lightweight aggregate.

Stone.—Stone output in Indiana in 1954 was valued at more than $27 million. Over half of this amount represents the value of dimension limestone, a product for which Indiana has long been famous. Crushed stone, used principally in road construction, concrete aggregate, agricultural limestone, and the manufacture of cement, constituted a major portion of the remainder. Smaller quantities of dimension sandstone were produced for use in building construction.

Production of Salem limestone, which yielded most of the building stone, was centered in Lawrence and Monroe Counties around Bedford and Bloomington. Leading dimension-stone producers include Indiana Limestone Co. and Ingalls Stone Co. at Bedford and Bloomington Limestone Corp., Empire Stone Co., and B. G. Hoadley Quarries, Inc., at Bloomington.

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Crushed stone was produced from limestones and dolomites. Ste. Genevieve limestone was the most important formation and was mined by numerous companies. It occurs in a belt that extends from Harrison and Crawford Counties, on the Ohio River, northward through Orange, Lawrence, Monroe, Owen, and Putnam Counties. Other Mississippian limestones also were quarried within and to the east and west of this belt. Crushed stone production was extensive in southeastern Indiana, where Silurian and Devonian limestone and dolomite were quarried in Clark, Scott, Jennings, Ripley, Bartholomew, Decatur, Shelby, and Rush Counties. Most of the crushed-stone production of northern Indiana came from Silurian dolomite and limestone.

The leading counties in crushed-stone production, in order of values reported, were Putnam, Newton, Crawford, Lawrence, Clark, Pulaski, and Grant. The major crushed-stone producers were Erie Stone Co., at Huntington and Bluffton; France Stone Co., which operated a quarry at Keeport (Cass County) and a grinding plant at Greencastle; Francesville Stone Co., Pulaski County; Mulzer Bros. near Eckerty (Crawford County) and at Derby (Perry County); Newton County Stone Co. east of Kentland; Ohio and Indiana Stone Co. at Greencastle; and Pipe Creek Stone Co. at Sweetser (Grant County).

Dimension sandstone was obtained from upper Mississippian and lower Pennsylvanian formations. Production was reported from Lawrence, Orange, Martin, and Parke Counties.

TABLE 7.—Limestone sold or used by producers, 1953–54, by uses

	1953			1954		
	Quantity	Value	Average value	Quantity	Value	Average value
Dimension:						
Building:						
Rubble—short tons	22,339	$39,356	$1.76	49,556	$128,984	$2.60
Rough construction—do				16,222	96,918	5.97
Rough architectural—cubic feet	2,154,832	2,380,991	1.10	2,498,519	3,154,864	1.26
Dressed (cut and sawed)—do	3,894,510	8,552,997	2.20	5,054,282	11,427,362	2.26
Total (short tons, approximate)[1]	460,916	10,973,344	23.81	613,356	14,808,128	24.14
Crushed and broken:						
Riprap—short tons	147,456	268,975	1.82	87,105	82,687	.95
Fluxing stone—do	94,699	115,364	1.22	98,576	122,936	1.25
Concrete aggregate, roadstone, etc.:						
Commercial—do	6,000,245	7,330,014	1.22	6,401,833	7,786,927	1.22
Noncommercial—do	50,000	50,000	1.00	3,668	4,966	1.35
Railroad ballast—do	364,099	429,794	1.18	320,720	391,296	1.22
Agriculture—do	1,952,490	2,488,027	1.27	1,945,673	2,646,616	1.36
Other—do	140,623	585,605	4.16	[2] 1,698,831	1,301,816	.77
Total crushed and broken—do	8,749,612	11,267,779	1.29	10,556,406	12,337,244	1.17
Grand total—do	9,210,528	22,241,123	2.41	11,169,762	27,145,372	2.43

[1] 145 pounds per cubic foot.
[2] Includes limestone for cement and lime.

Sulfur.—The Standard Oil Co. of Indiana recovered liquid sulfur by the Mathieson Fluor process at its Whiting refinery. Sulfur recovery was from crude petroleum, which was largely obtained from other States.

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REVIEW BY COUNTIES

Adams.—Krick Tyndall Co. mined clays at Decatur for manufacturing heavy clay products. Limestone, quarried by John W. Karch Stone Co. at Bryant and Meshberger Bros. Stone Corp. at Linngrove and Pleasant Mills, was sold for concrete aggregate, agricultural use, and roadstone. Lybarger Gravel Co., Geneva, produced gravel for use in building construction and as fill.

Allen.—Sand and gravel for building and road use was produced by Paul C. Brudi Stone & Gravel Co., Inc., and May Sand & Gravel Corp., both of Fort Wayne, and by the W & W Gravel Co., Inc., Roanoke. Walter Bolyard Tile Co., Monroeville, and Klopfenstein Tile Works, Grabill, mined clays for use in manufacturing heavy clay products. May Sand & Gravel Corp. also quarried limestone that was crushed and sold for road use, concrete aggregate, and agricultural limestone.

Bartholomew.—Charles Tobias, Columbus, produced gravel for local use. Meshberger Stone Co., Inc., quarried and crushed limestone and dolomite at Columbus. Production was sold for concrete aggregate, aglime, roadstone, riprap, and flux.

TABLE 8.—Value of mineral production in Indiana, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value
Adams	$434,411	$417,369	Stone, clays, sand and gravel.
Allen	353,349	656,180	Sand and gravel, stone, clays.
Bartholomew	(2)	(2)	Stone, sand and gravel.
Benton	2,400	(2)	Sand and gravel.
Blackford	83,250	(2)	Stone, clays, peat.
Boone	(2)	(2)	Sand and gravel.
Carroll	(2)	330,113	Stone, sand and gravel.
Cass	448,618	(2)	Do.
Clark	9,521,438	14,845,479	Cement, stone, sand and gravel.
Clay	966,011	447,560	Clays, sand and gravel.
Clinton	29,302	29,250	Sand and gravel.
Crawford	(2)	(2)	Stone.
Daviess	(2)	(2)	Sand and gravel, clays.
Dearborn	142,584	(2)	Sand and gravel.
Decatur	(2)	(2)	Stone.
De Kalb	125,568	(2)	Sand and gravel, peat.
Delaware	417,333	724,585	Sand and gravel, stone.
Dubois	27,478	66,045	Clays, sand and gravel.
Elkhart	63,121	226,139	Sand and gravel.
Fayette	(2)	205,352	Do.
Fountain	192,970	69,820	Clays, sand and gravel.
Franklin	(2)	(2)	Do.
Fulton	3,000	48,500	Sand and gravel, marl.
Gibson	(2)	(2)	Sand and gravel.
Grant	942,097	(2)	Stone, sand and gravel, peat.
Greene	(2)	(2)	Clays, sand and gravel.
Hamilton	(2)	357,802	Sand and gravel, stone, peat.
Hancock	116,263	(2)	Sand and gravel.
Harrison	(2)	(2)	Stone.
Hendricks	(2)	(2)	Sand and gravel.
Henry	(2)	64,039	Do.
Howard	----------	(2)	Stone, sand and gravel.
Huntington	(2)	319,124	Stone, sand and gravel, clays.
Jackson	(2)	208,671	Clays, sand and gravel, stone.
Jasper	(2)	145,014	Stone, sand and gravel.
Jay	81,600	(2)	Stone, clays.
Jennings	(2)	(2)	Stone.
Johnson	----------	(2)	Sand and gravel.
Knox	(2)	260,102	Do.
Kosciusko	223,289	156,015	Do.
Lagrange	140,039	195,267	Do.
Lake	18,446,187	19,387,343	Cement, sulfur, clays, sand and gravel.
La Porte	(2)	383,135	Sand and gravel.
Lawrence	11,491,629	13,056,820	Stone, cement, sand and gravel.
Madison	(2)	659,372	Sand and gravel, stone.

See footnotes at end of table.

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TABLE 8.—Value of mineral production in Indiana, 1953–54, by counties [1]—Continued

County	1953	1954	Minerals produced in 1954 in order of value
Marion	$1,850,716	$2,522,447	Sand and gravel, peat.
Marshall	(2)	73,741	Sand and gravel, clays, marl.
Martin	(2)	(2)	Clays, stone.
Miami	(2)	320,867	Sand and gravel.
Monroe	5,319,686	7,069,004	Stone, sand and gravel.
Montgomery	(2)	151,114	Sand and gravel, clays.
Morgan	77,052	384,829	Clays, stone, sand and gravel.
Newton	660,000	646,000	Stone.
Noble	3,004	28,473	Sand and gravel, marl.
Orange	230,361	(2)	Stone, abrasives.
Owen	498,805	394,832	Stone, clays, sand and gravel.
Parke	201,000	160,684	Clays, stone, sand and gravel.
Perry	(2)	379,473	Stone, clays, sand and gravel.
Porter	205,758	180,014	Sand and gravel, clays.
Posey	(2)	96,424	Sand and gravel.
Pulaski	398,337	(2)	Stone, clays, sand and gravel.
Putnam	5,962,273	6,614,952	Cement, stone, clays, sand and gravel, lime.
Randolph	(2)	174,026	Stone, sand and gravel.
Ripley	191,065	77,225	Stone.
Rush	(2)	219,689	Stone, sand and gravel.
St. Joseph	292,794	428,596	Sand and gravel.
Scott	(2)	(2)	Stone.
Shelby	258,919	478,860	Stone, sand and gravel.
Spencer	(2)	(2)	Sand and gravel.
Starke	(2)	(2)	Do.
Steuben	----------	259,282	Sand and gravel, peat.
Sullivan	(2)	147,502	Sand and gravel.
Switzerland	3,479	64,000	Stone.
Tippecanoe	(2)	(2)	Sand and gravel.
Vanderburgh	(2)	(2)	Sand and gravel, clays.
Vermillion	672,650	648,700	Do.
Vigo	623,357	435,900	Do.
Wabash	----------	71,067	Sand and gravel, marl.
Warren	----------	(2)	Sand and gravel.
Warrick	(2)	(2)	Stone, sand and gravel.
Washington	----------	(2)	Sand and gravel.
Wayne	148,015	556,144	Sand and gravel, stone.
Wells	308,734	292,387	Stone, sand and gravel, peat.
White	481,750	313,000	Stone.
Whitley	(2)	115,792	Sand and gravel.
Undistributed	107,140,977	88,805,282	
Total	169,781,000	165,369,000	

[1] Except for value of coal, natural gas, and petroleum which was not available by counties, value included with "Undistributed." The following counties are not listed because no production was reported: Brown, Floyd, Jefferson, Ohio, Pike, Tipton, and Union.
[2] Included with "Undistributed."

Benton.—Gravel for road use was produced by the Mount Gilboa Gravel Co., Fowler.

Blackford.—Inman Tile Co., Hartford City, produced clays for use in heavy clay products. Montpelier Stone Co., Inc., Montpelier, quarried limestone for agricultural and road purposes. Hartford Peat & Gravel Co. produced reed or sedge peat from its bog for soil conditioning.

Boone.—Sand and gravel for building and road use was produced by Harold Blacker of Colfax; Glen Reagan, Lebanon; and the Routh Gravel Plant, Zionsville.

Carroll.—Sand and gravel for building and road construction was produced by Brim Gravel Transit Mix Co., Inc., and Deer Creek Gravel Co., both of Flora; Chester Brovont, Camden; Lloyd Gangwer, Cutler; and the S & L Gravel Co. of Marion. Stuntz Yoeman Co., Inc., produced aggregate, roadstone, and aglime from its quarry at Delphi.

Cass.—The Great Lakes Foundry Sand Co. of Detroit, Mich., produced sand from a pit near Lake Cicott, and the Greenville Gravel

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Co., Logansport, produced sand and gravel for building purposes. Crushed limestone for use as aggregate, aglime, and roadstone was produced by the Cass County Stone Co. and France Stone Co. at Logansport. The France firm also produced stone for railroad ballast and metallurgical flux.

Clark.—Walter J. Hieb Sand & Gravel, Inc., of Louisville, Ky., and Yoder Same, Concrete Block Shop, Jeffersonville, produced sand and gravel for building use and for railroad ballast. At its Speed plant the Louisville Cement Co., Inc., produced portland and natural cement and limestone and clays for use in manufacturing cement. T. J. Atkins & Co., Inc., Jeffersonville, and Sellersburg Stone Co., Sellersburg, produced limestone for agricultural and road use and concrete.

Clay.—Sand and gravel for building and road use was produced by Clyde Bullerdick, Poland; Joe Conrad, Frankfort; and the H & H Sand & Gravel, Brazil. Underclays from the Block coals were produced by E & K Clay Co., Quality Coal Corp., and Ren Coal Co., all of Brazil, and the Brown Coal Co. and Log Cabin Coal Co., both of Centerpoint. The Big Bend Collieries, Inc., and the G & F Coal Corp., both of Brazil, produced underclays and lower Pennsylvanian shales. End use was for firebrick, heavy clay products, high-grade tile, etc. Coal was produced from strip mines by Ayrshire Collieries Corp. (Chinook mine), Big Bend Collieries, Inc., Brown Coal Co., G & F Corp. (Hickory No. 2 mine), Gillespie Coal Co., Ren Coal Co., Standard Brazil Block Coal Co., and Turner, Thompson & Albin Coal Co.

Clinton.—Road gravel was produced for the Clinton County Highway Department.

Crawford.—Hy-Rock Products Co., Marengo, and Mulzer Bros., Eckerty, produced limestone for use as aggregate, roadstone, and agricultural purposes. The Hy-Rock firm also produced railroad ballast and riprap.

Daviess.—John E. Mize, Elnora, and Western Sand & Gravel Co., Plainville, produced sand and gravel for building and road construction. Kretz Brick Co., Washington, mined clay for use in heavy clay products. Loogootee Block Coal Co., Inc., Washington, produced coal from a strip mine.

Dearborn.—Dearborn Gravel Co., Lawrenceburg, and the Laughery Gravel Co., Inc., Aurora, produced sand and gravel for building and road use.

Decatur.—Limestone was quarried by the Harris City Stone Corp. at Greensburg, Layton Stone Co. at Westport, and the New Point Stone Co. at New Point. Flagging, aggregate, rubble, roadstone, and agricultural limestone were produced.

De Kalb.—Sand and gravel for building and road construction was produced by Tom Day and Flegal & Faber, Inc., both of Hamilton; Irving Ready Mix, Inc., Harlan; Harold J. Krafft, Spencerville; and Stonestreet & Burtzner Bros., Waterloo. Humus Peat Moss Co. produced peat at Corunna for soil-improvement purposes.

Delaware.—Sand and gravel, chiefly for building and road construction, was produced by Fullhart Sand & Gravel, J & K Stone & Gravel, Inc., Muncie Excavating Co., and Park Sand & Gravel Co., all of Muncie; and Robert E. Wright, Albany.

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Limestone was also produced by the J & K Stone & Gravel, Inc., from two quarries at Muncie and Eaton. It was crushed and used as roadstone, concrete aggregate, and agricultural limestone.

Dubois.—Hoffman Sand & Gravel, Jasper, produced sand for building purposes. Hugo Bartlet and Huntingburg Brick Co., both at Huntingburg, and Louisville Firebrick Works, at Duff, produced clays for use in manufacturing firebrick, stoneware, and heavy clay products. The Louisville Pottery Co. produced underclay from the Minshall coal bed for use in manufacturing stoneware. Coal from underground mines was produced by Ackerman Coal Co. and Merhenger & Frick.

Elkhart.—Sand and gravel, mostly for building and road use, was produced by Christner Gravel Co., Inc., Goshen Sand & Gravel Co., and Donald Rohrer, all of Goshen; Elkhart Gravel Corp. and Yoder Ready Mix Concrete Co., Inc., both of Elkhart; and Charles W. Cobb, New Paris.

Fayette.—Christensen Gravel Co., Connersville Gravel Co., Inc., and Grubbs Bros., all of Connersville, produced sand and gravel, chiefly for building and road construction. The Fayette County Highway Department produced road gravel.

Fountain.—Neal Gravel Co., Covington, and Towell & Towell, Kingman, produced sand and gravel. Poston-Herron Brick Co. and Rostone Corp. mined clays at Attica for use in producing heavy clay products. Economy Coal Co. produced coal from a strip mine.

Franklin.—Bruns Gravel Co., Brookville, produced gravel for building purposes. Herman H. Wessel Co. produced miscellaneous clay at Huntersville for use in manufacturing heavy clay products.

Fulton.—Sand and gravel, chiefly for use in building and road construction, was produced by Bert & Cecil Davis and S S & B Gravel Co., both of Leiters Ford; George E. Metzger and Van Duyne Block & Gravel, both of Rochester; and C. G. Smith, Akron. M. E. Zellers produced marl at Rochester for agricultural purposes.

Gibson.—Charles A Griffin, Princeton, and Johnson Gravel Co., Owensville, produced sand and gravel, used mostly for building and road construction. Princeton Mining Co. produced coal from an underground mine near Princeton. Winslow Coal Corp., Somerville, operated a strip mine. Saxton Coal Corp. operated a strip mine near Oakland City.

Grant.—Irving Bros. Gravel Co., Inc., Marion, produced sand and gravel for building and road use. Pipe Creek Stone Co. operated a limestone quarry at Mier producing aggregate, rubble, riprap, flagging, roadstone, aglime, and blast-furnace flux. Glacier Peat Moss Co. produced moss peat at Jonesboro for use as a soil conditioner.

Greene.—Concrete Silo Co., Inc., and Nocus & Schofield, both of Bloomfield, produced sand and gravel for use in building and road construction. A small amount of engine sand also was produced. Bloomfield Brick Co., Bloomfield, mined clays for use in manufacturing heavy clay products. Maumee Collieries Co. produced coal from Airline mine No. 32 and Linton No. 28; both were strip operations. South Linton Coal Co. produced coal from an underground mine.

Hamilton.—Filter sand and sand and gravel for use in building and road construction were produced in Hamilton County. Producers

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include Curt Ayers of Lebanon; Beaver Gravel Co., Clark Materials, Chauncey Craig, Newton Gravel Co., and Clarence Russell, all of Noblesville; Carmel Gravel Corp., Carmel; and Hoffman & Son, Sheridan. Stony Creek Stone Co., Noblesville, operated a limestone quarry and produced aggregate, riprap, roadstone, and limestone for agricultural purposes. Fox Prairie Products, Inc., Noblesville, produced moss peat for agricultural use.

Hancock.—Sand and gravel for building and road use was produced by Irving Materials, Inc., Delbert L. Reeves Sand & Gravel, and Ed. Strubbe & Sons, all of Greenfield.

Harrison.—Corydon Crushed Stone & Lime Co., Corydon, and Davis Crushed Stone & Lime Co., Ramsey, reported production of aggregate, roadstone, and agricultural limestone.

Hendricks.—Galen Groninger, Plainfield, produced gravel for road use.

Henry.—Sand and gravel, mostly for use in building and road construction, was produced by Cooper & Priest, Paul Craig, and Harry I. McNew, all of Knightstown; Robert Hall, Lewisville; J. L. McDonald, Honey Creek; Parker Gravel Co., New Castle; and A. Riley, Middletown. The Henry County Highway Department produced road gravel.

Howard.—Ted McKinney & Son, Tipton, produced sand and gravel for use in building and road construction. Yeoman Stone Co., Kokomo, operated a limestone quarry and produced stone for concrete aggregate, roadstone, and rough construction and limestone for agricultural purposes.

Huntington.—Road gravel was produced by the S & L Gravel Co. of Marion and for the Huntington County Highway Department. Erie Stone Co. operated a limestone quarry at Huntington and produced mineral wool, blast-furnace flux, railroad ballast, roadstone, concrete aggregate, and agricultural limestone. Majenica Tile Co., Huntington, produced heavy clay products from miscellaneous clay.

Jackson.—Medora Concrete Block Plant (Medora) and Seymour Gravel Co., Inc., and the Spray Gravel Plant (both at Seymour) produced sand and gravel for building and road use. Jackson Brick & Hollow Ware Co., at Brownstown, and Medora Brick Co., Medora, produced miscellaneous clay. The Lehigh Portland Cement Co., Mitchell, produced shale for use in cement from a pit near Brownstown.

Jasper.—Peter Dziabis and Rensselaer Gravel Co., both of Rensselaer, produced sand and gravel, mostly for use in building and road construction. W. C. Babcock Construction Co. quarried limestone at Rensselaer for use as aggregate, roadstone, and for agricultural purposes.

Jay.—Martin Tile Co., Dunkirk, mined miscellaneous clay for its own use. Rockledge Products Co., Portland, produced dolomite for road use and agricultural purposes.

Jennings.—Paul Frank operated a quarry at North Vernon and produced aggregate, roadstone, and agricultural limestone.

Johnson.—Driftwood Gravel Co., Columbus, produced sand and gravel for building and road use.

Knox.—Sand and gravel for building and road use was produced by Lenahans & Konen, Inc., Nally, Ballard & Cato, Inc., Schlommer & Son, and White River Materials, Inc., all of Vincennes. Enoco Col-

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lieries, Inc., produced coal from an underground coal mine, and Shasta Coal Corp. operated a strip mine. Wolfe Koenig Coal Co. produced coal from two underground mines.

Kosciusko.—Engine sand and sand and gravel for use in building and road construction and for railroad ballast were produced in Kosciusko County. Producers include Wash I. Anglin, Etna Green; H. D. Fuller and Roy R. Ruse, both of Warsaw; Charles Smith, Pierceton; Sturm & Dillard Gravel Co., Syracuse; Robert Teeple, Leesburg; and Zimmerman & Sons Sand & Gravel, Milford. Road gravel was produced by and for the Kosciusko County Highway Department.

Lagrange.—Sand and gravel for building and road use was produced by the Northern Indiana Sand & Gravel Co., Wolcottville, and Northrup Gravel Co. and Vern A. Pant, both of Lagrange. The Lagrange County Highway Department produced road gravel.

Lake.—Molding sand and sand and gravel for building and road use were produced in Lake County. Producers include John N. Bos Sand Co., Chicago, Ill.; J. K. Hall & Sons and Effie M. Tyler, both of Lowell; Vic Kirsch Construction Co., Inc., Hammond; and Samocki Construction Co., East Chicago. Universal Atlas Cement Co. produced portland and alumina cement at its Buffington plant. Miscellaneous clay was mined by the Natco Corp. at Hobart and National Brick Co., Munster, for manufacturing heavy clay products. Standard Oil Co. of Indiana recovered elemental sulfur at its Whiting refinery for its own use.

La Porte.—Molding and engine sand, as well as sand and gravel for use in building and road construction, were produced in La Porte County. Producers include Clyde A. Bean, Rolling Prairie; Cross & Griffith and Producers Core Sand Corp., both of Michigan City; George L. Lambert, La Porte; Portage-Manley Sand Co., Rockton, Ill.; and J & A Gravel Co., Walkerton.

Lawrence.—Lawrence County continued to be the leading dimension-stone-producing county in the State and one of the most important centers of dimension-stone production in the Nation.

Production of dimension limestone was reported by Indiana Limestone Co. and Ingalls Stone Co. In addition to dimension limestone for building purposes, crushed limestone for use as blast-furnace flux, concrete aggregate, and roadstone and for agricultural purposes was produced. Producers include the Springville quarry of Ralph Rogers Co., Oolitic Ground Limestone Co. at Bedford, and Mitchell Crushed Stone Co., Inc., at Georgia. In addition, a substantial quantity of mill scrap was processed by the Bedford Ground Limestone Co. in Bedford. The Indiana Sandstone Co. operated a quarry near Huron and produced sawed sandstone. At Mitchell the Lehigh Portland Cement Co. produced portland cement and limestone used in manufacturing cement. C. E. Flynn, Bedford, produced a small quantity of fill sand.

Madison.—Building and road construction were the chief uses for sand and gravel produced in Madison County. Producers include Raymond Bolander, Noblesville; Chalk Excavating Co., Myers Gravel & Sand Co., Inc., Riggs Equipment Co., and Stiner Gravel Co., all of Anderson; Pendleton Sand & Gravel Co., Pendleton; Richardson Sand & Gravel Co., Frankton; Norman Stanley, Chesterfield; Ward

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Stohler, Markleville; and Western Indiana Gravel Co., of Lafayette. Standard Materials Corp. of Indianapolis operated a limestone quarry at Lapel and produced concrete aggregate, riprap, roadstone, and agricultural limestone.

Marion.—Sand and gravel for use in building and road construction and for railroad ballast was produced in Marion County. Producers included American Aggregates Corp., Greenville, Ohio; Frank Wicker & Son, Greenwood; and John Jones & Sons, Inc., F. J. Schuster Coal Co., Speed Gravel Co., Spickelmier Co., and Standard Materials Corp., all of Indianapolis. Peat Moss Indianapolis, Inc., produced humus peat near Indianapolis.

Marshall.—Sand and gravel, mostly for building and road use, was produced in Marshall County. Producers were Fred Appleman, Leroy Balsley, O. S. Goss & Sons, and Marvin Wood, all of Plymouth; Burns Gravel Co., Burr Oak Sand & Gravel Co., and R & B Gravel Co., all of Culver; Mutti Gravel Pit and Noble Reese, both of Bremen; Nelson Reed and David Stayton, both of Argos; and Broda Starnes, Tippecanoe. Bremen Clay Products Co., Bremen, mined miscellaneous clay for manufacturing heavy clay products. Sylvester Harness produced marl near Grovertown for agricultural purposes.

Martin.—Loogootee Clay Products Corp., Loogootee, mined miscellaneous clay. The output was used for heavy clay products. National Gypsum Co. and United States Gypsum Co. each had under development gypsum-bearing properties in the vicinity of Shoals. French Lick Sandstone Co. opened a quarry for dimension sandstone at Trinity Springs early in the year.

Miami.—D. R. Keim (Roann), Kickapoo Sand & Gravel Corp., J. C. O'Connor & Sons, Inc. (both of Fort Wayne), and Jess Richardson (Peru) produced sand and gravel for building and road use.

Monroe.—Limestone was the principal mineral commodity produced in Monroe County; most of it was sold as sawed and cut stone. Leading producers include Bloomington Limestone Corp., Carl Furst Co., Empire Stone Co., B. G. Hoadley Quarries, Inc., Independent Limestone Co., Indiana Limestone Co., Midwest Quarries, Inc., Texas Quarries, Inc., Walker Bros., Woolery Stone Co., Inc., all at Bloomington, and Victor Oolitic Stone Co., Victor. In addition, 12 mills cut and dressed stone purchased from the quarries. Indiana Calcium Corp. operated a fine-grinding plant to produce high-calcium limestone from the mill spalls of the building-stone district. Bloomington Crushed Stone Co. abandoned its quarry in the Harrodsburg limestone at the north edge of Bloomington and opened a new quarry in the Ste. Genevieve limestone 4 miles west of Bloomington. Crushed limestone for road use, concrete aggregate, agricultural purposes, and miscellaneous industrial uses also was produced in the county.

Montgomery.—Sand and gravel for building and road use was produced by James A. Kitts, Alex Le Jeune, Harry Petro, Jr., and Lloyd E. Smith, all of Crawfordsville, and Sherman Thompson, of Roachdale. Hydraulic Press Brick Co., Crawfordsville, mined miscellaneous clay for use in manufacturing heavy clay products.

Morgan.—Sand and gravel, mostly for building and road use, was produced by Randolph Adams, Perle Hill Gravel Plant, Kivett Gravel Co., and Jessup Sand & Gravel Co., all of Martinsville; Edwards

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Sand & Gravel Co., Monrovia; and Milhon & Anderson Gravel Co., Mooresville. Clays were produced in the county by Adams Clay Products Co., Martinsville, and Brooklyn Brick Co. and Indiana Drain Tile Co., Inc., both of Brooklyn. Output was utilized in the manufacture of brick, tile, and other heavy clay products. Porter Cave Stone Co. near Gosport operated a quarry and produced aggregate, roadstone, and agricultural limestone. Construction was begun on a plant south of Brooklyn to produce lightweight aggregate by bloating lower Mississippian shale.

Newton.—Limestone of Ordovician age was produced by the Newton County Stone, Inc., Kentland. Production was used for concrete aggregate, roadstone, and agricultural purposes.

Noble.—Sand and gravel for road and building construction was produced by Campbell & Son and Edward Tipton, both of Albion, and Forest Geiger, of Churubusco. Calcareous marl was produced in the county by Kenneth Forker and Luther & Haney, both of Albion, and Sylvan O. Shull, Rome City. The output was used for agricultural purposes.

Orange.—Calcar Quarries, Paoli, and Radcliff & Barry, Inc., Orleans, produced concrete aggregate, roadstone, and agricultural limestone. The Radcliff & Barry firm operated quarries northwest of Orleans and west of Paoli. Indiana Sandstone Co. produced whetstones from quarries and a mill west of Orleans. French Lick Sandstone Co., Inc., which operates a mill at French Lick, quarried sandstone near Prospect during the early part of the year but moved its operation to Trinity Springs in Martin County. Sandstone-quarry blocks for sawed and split-face stone were produced.

Owen.—Gosport Gravel Co., Inc., Gosport, and Clayton Winders & Sons, Spencer, produced sand and gravel for building and road use. The Maumee Collieries Co. mined fire clay at Coal City for use in manufacturing tile and heavy clay products. France Stone Products, Inc., and Dunn Limestone Co., Inc., quarried limestone at and near Spencer to produce riprap, blast-furnace flux, roadstone, concrete aggregate, railroad ballast, and agricultural limestone. Maumee Collieries Co. operated the Old Glory No. 33-mine near Coal City, and Burcham Bros. produced coal from strip mines near Patricksburg.

Parke.—Road gravel was produced from the Red Top Gravel Pit, Rosedale. Clays were mined by Cayuga Brick & Tile Co. at Bloomingdale, S. L. Turner Coal & Clay Co. at Carbon, and Clay City Pipe Co. at Mecca. Heavy clay products were produced. Mansfield Stone Corp., Mansfield, quarried sandstone that was sold for rough construction use and as sawed building stone. Coal was produced from strip mines by Gerrard & Presley Coal Co., Maple Grove Coal Co., and Sid L. Turner.

Perry.—Sand and gravel for building use was produced by Ohio Valley Co., Tell City. Cannelton Sewer Pipe Co., Cannelton, and U. S. Brick Co., Tell City, produced clays for use in manufacturing heavy clay products. Mulzer Bros. quarried limestone at Derby for use as concrete aggregate, roadstone, and railroad ballast.

Pike.—Coal production was from strip operations. Producers include Ayrshire Collieries Corp., Blackfoot Coal & Land Corp., Conder Coal Co., and Enos Coal Mining Co.

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Porter.—Molding, building, paving, and engine sand was produced in Porter County by John N. Bos Co. of Chicago, Ill.; Crisman Sand Co., Inc., of Gary; and Portage-Manley Co. of Rockton, Ill. Fire and miscellaneous clays were produced by J. S. Robbins, McCool, and Charles H. Schrock, Chesterton.

Posey.—Sand and gravel for use in building and road construction and for railroad ballast was produced by Hageman Sand & Gravel Co. and McDonald Sand & Gravel Co., both of Mount Vernon; and New Harmony Sand & Gravel Co., Inc., New Harmony.

Pulaski.—Chas. C. Engel, Monterey, produced sand and gravel for road construction. Francesville Drain Tile Co., Francesville, mined miscellaneous clay for use in manufacturing heavy clay products. Francesville Stone Co., Francesville, produced roadstone and agricultural limestone.

Putnam.—Clark & Son Sand & Gravel Co., Brazil, produced sand and gravel for building and road use. The Limedale plant of the Lone Star Cement Corp. produced portland cement and quarried limestone for use in manufacturing cement. Indiana State Farm, Greencastle, mined miscellaneous clay for use in brickmaking. The farm also produced a small quantity of lime and quarried limestone at Putnamville for agricultural use. All products were for use on State property. Crushed limestone for use as riprap, blast-furnace flux, filler, dusting agent, railroad ballast, concrete aggregate, and roadstone and for agricultural purposes was produced by France Stone Products, Inc., at Greencastle, Manhattan Crushed Stone Co. at Reelsville, Ohio, Indiana Stone Corp. at Greencastle, and Russellville Stone Co. at Russellville.

Randolph.—Ernest L. Habben, Economy; Hutchens Gravel Co., Lynn; Pugh Gravel Co., Modoc; and Marshall Retz, Winchester, produced sand and gravel, chiefly for building and road construction. Dolomite for use as aggregate and roadstone and for agricultural purposes was produced by H & R Stone Co., Ridgeville, and Hiatt Stone Co., Albany.

Ripley.—Ripley County Construction Co. quarried limestone at Osgood to produce rubble, roadstone, concrete aggregate, and agricultural limestone.

Rush.—Alexander Gravel Co. and Johnson & Johnson Gravel Co., both of Carthage; Delbert Winkler, Arlington; and W. P. Wolfal Co., Rushville, produced sand and gravel for building and road use. Concrete aggregate, roadstone, and agricultural limestone were produced by McCorkle Stone Co. near Milroy and Rush County Stone Co. at Milroy.

St. Joseph.—Sand and gravel for use in building and road construction was produced by Concrete Products Corp. and Dry Island Sand & Gravel Co., both of Mishawaka; C. D. Smelser Co., Inc., South Bend Sand-Gravel Corp., George Toth, and P. L. Wilson, all of South Bend; and John G. Yerington of Benton Harbor, Mich. Sand and gravel for road use was produced by and for the St. Joseph County Highway Department.

Scott.—Scott County Stone Co., Inc., Scottsburg, produced concrete aggregate, roadstone, and agricultural limestone from a quarry south of Blocher. Airlite Processing Corp., Scottsburg, expanded

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perlite, shipped from Southwestern States, for use as a lightweight aggregate for plaster and concrete.

Shelby.—Blue River Packing Co. and Elmer Caldwell, both of Morristown, and E. T. Burnside and Shelby Gravel, Inc., both of Shelbyville, produced sand and gravel for building and road use. Limestone and dolomite for use as concrete aggregate, roadstone, blast-furnace flux, railroad ballast, and agricultural purposes was produced by Cave Stone Co., Inc., of Flat Rock and St. Paul Quarries, Inc., of Indianapolis.

Spencer.—Molding sand and sand and gravel for use in building and road construction was produced by Bedford-Nugent Co. and Hardy Sand Co., both of Evansville. Coal from an underground mine was produced at St. Meinrad Abbey.

Starke.—Bass Lake Gravel Co. and Bruce Fletcher, both of Knox produced sand and gravel for building and road use.

Steuben.—Sand and gravel produced in the county was used for building and road construction and for railroad ballast. Producers were Angola Sand & Gravel Co., Conway Garnes, and Stonestreet Gravel Co., Inc., all of Angola; Pleasant Lake Gravel Co. and Stroh Sand & Gravel, both of Pleasant Lake; Emery Spade, Orland; and Michigan Turnpike Gravel Co. of Coldwater, Mich. The Steuben County Highway Department produced road gravel. A. D. Ritter, Angola, produced peat for use as a soil conditioner.

Sullivan.—Engine sand and sand and gravel for building and road use and for railroad ballast was produced in the county. Producers include Burton Gravel Co., Sullivan; W. Carlisle Sand & Gravel Co., Carlisle; and Merom Gravel Co., Indianapolis. Coal production in Sullivan County was both from strip mines and underground operations. Maumee Collieries Co. (Sullivan No. 27 mine), S. A. Coal Co., and Sherwood-Templeton Coal Co. (Friar Tuck mine) operated strip mines. Underground operations were conducted by Buck Creek Coal Co., Fairview Collieries Corp., Linton Summit Coal Co., and Pandora Coal Corp.

Switzerland.—Tri County Stone Co., Osgood, operated a limestone quarry south of Cross Plains to produce concrete aggregate, roadstone, and agricultural limestone.

Tippecanoe.—Acme Materials, Inc., Lafayette, and E. H. Smith, Battle Ground, produced sand and gravel for building and road use.

Vanderburgh.—Bedford-Nugent Co. and Koch Sand & Gravel Co., both of Evansville, produced sand and gravel. The principal uses were for building and road construction, railroad ballast, and engine sand. Standard Brick & Tile Co., Evansville, mined miscellaneous clay used in manufacturing heavy clay products.

Vermillion.—Sand and gravel for building and road use and railroad ballast was produced in the county. The principal producers were Material Service Corp., Chicago, Ill.; Neal Gravel Co., Covington; Standard Materials Corp., Indianapolis; and Samuel Ramsey, Perrysville. Fire clay was mined by Arketex Ceramic Corp. at Dana and by Clay City Pipe Co. at Montezuma. Output was used in manufacturing firebrick and high-grade tile. Ayrshire Collieries Corp. produced coal from the Sun Spot mine, a strip operation.

Vigo.—Engine sand and sand and gravel for building and road use and for railroad ballast were produced in the county. Producers, all

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in Terre Haute, were G. A. Monninger, Quinn Gravel Co., Terre Haute Gravel Co., Inc., and Wabash Sand & Gravel Co., Terre Haute Vitrified Brick Works, Inc., mined miscellaneous clay at West Terre Haute used in manufacturing heavy clay products. Coal was produced from underground mines by the Mount Pleasant Mining Co., Pyramid Coal Corp., Snow Hill Coal Corp., Tri-K Mining Co., and Viking Coal Corp. Maumee Collieries Co. produced coal from a strip mine.

Wabash.—Sand and gravel for building or road construction was produced by Hubert Baker, Wabash; Frank & Miller Gravel & Ready Mix Co., Somerset; Ralph Jacobs Estate, Urbana; and E. Lines, LaFontaine. Road gravel was produced by and for the Wabash County Highway Department. Laketon Marl & Gravel Co., Laketon, produced gravel and marl.

Warren.—Neal Gravel Co. of Covington and Roderick Gravel Co., West Lebanon, produced sand and gravel for use in building and road construction.

Warrick.—Newburgh Sand & Gravel, Inc., Newburgh, produced sand and gravel for road and building use. Lemmons & Co. produced and crushed limestone at Lynnville for use as roadstone. Boonville Collieries Corp., Tecumseh Coal Corp., Victoria Coal Corp., and L. G. Wasson Coal Mining Corp. produced coal from strip mines.

Washington.—Ewing & Hattabaugh, Vallonia, produced road gravel.

Wayne.—Sand and gravel for building and road use and railroad ballast was produced by Americaa Aggregates Corp., of Greenville, Ohio; DeBolt Concrete Co., Inc., Richmond; Fisher Gravel Co., Hagerstown; and Kirkpatrick Gravel Co., Inc., Cambridge City. The city of Richmond produced gravel for road use, and the Wayne County Highway Department contracted for sand for paving and road construction. DeBolt Concrete Co., Richmond, operated a limestone quarry and produced aggregate, riprap, railroad ballast, roadstone, and agricultural limestone.

Wells.—Irvin Gravel & Supply, Bluffton, produced sand and gravel for building and road use. Dolomite was quarried at Bluffton by Erie Stone Co., and limestone was quarried at Rockford by Heller Stone Co. The output was used for concrete aggregate, roadstone, agricultural purposes, rough construction, riprap, and blast-furnace flux. Thurl Ballard and William Graves, both of Warren, produced moss peat.

White.—Monon Crushed Stone Co., Monon, produced agricultural limestone, concrete aggregate, roadstone, and railroad ballast.

Whitley.—Sand and gravel for use in road and building construction was produced by Allen-Whitley County Gravel Co., Inc., Furlow Bird, and Elmer A. Lauer, all of Columbia City; and Theodore W. Hockmeyer, South Whitley.

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The Mineral Industry of Iowa

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, United States Department of the Interior, and the Geological Survey of Iowa.

By Donald F. Klyce [1]

MINERAL output in Iowa in 1954 had an aggregate value of $58,798,000, an alltime high and 13 percent greater than in 1953. Gains in the production of cement, sand and gravel, and stone accounted for most of the increase.

In 1954 only nonmetallic minerals and mineral fuels were produced in Iowa. In order of value these mineral commodities were cement, stone, sand and gravel, bituminous coal, gypsum, clays, peat, and lime.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Bureau of the Census totals when they are available and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

Table 1 shows production and value of minerals produced in Iowa 1953–54.

TABLE 1.—Mineral production in Iowa, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement, portland.....376-pound barrels	9,111,358	$23,330,177	9,858,889	$27,044,464
Clays	913,413	974,539	882,849	920,859
Coal [2]	1,388,006	5,262,373	1,196,698	4,502,561
Gypsum	1,151,692	2,939,654	1,106,626	3,035,651
Peat	17,233	(3)	(3)	(3)
Sand and gravel	10,385,322	6,400,827	12,199,656	9,276,530
Stone (except limestone for cement and lime 1953)	10,715,078	13,215,352	13,240,087	16,388,141
Undistributed: Lead, lime, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		224,242		252,269
Total Iowa		[4] 51,994,000		[4] 58,798,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Relates only to mines with a production of 1,000 tons or more.
[3] Bureau of Mines not at liberty to publish; values combined under "Undistributed."
[4] The total has been adjusted to eliminate duplication in the value of clays and stone.

[1] Commodity industry analyst, Region V, Bureau of Mines, Minneapolis, Minn.

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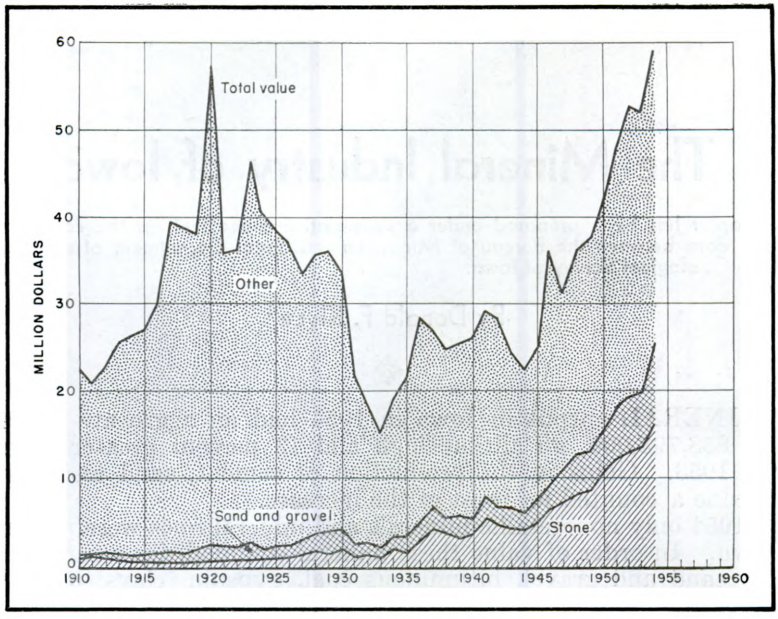

FIGURE 1.—Value of all minerals, sand and gravel, and stone (all types—separate data for stone not available 1910–18) produced in Iowa 1910–54.

REVIEW BY MINERAL COMMODITIES

METALS

Metals were not produced in Iowa in 1954. However, lead concentrate containing 4 tons of lead, in terms of recoverable metal, was marketed during the year. This material resulted from exploration of a lead-zinc property in Dubuque County by Durango Mining Co. in 1951–53. Accordingly this production has been credited in the year marketed, although no mining activity was reported during 1954.

NONMETALS

Cement.—Portland and masonry cement was produced in Cerro Gordo, Polk, and Scott Counties at five plants. Types I and II, general use and moderate heat, were produced at all five plants; type III, high-early-strength, was produced at four plants. Air-entrained cement was produced at four plants. Four plants produced masonry cements from portland cement. Shipments of portland cement in 1954 were 9,859,000 barrels, an 8-percent increase over 1953. The quantity and value of shipments of masonry cement were not included in the State total, since the portland cement used in manufacturing masonry cement was included with portland-cement shipments. The average value of portland cement in 1954 was $2.74 per barrel and

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$2.56 in 1953. The average value of masonry cement in 1954 was $3.44 per barrel and $3.28 in 1953.

Clays.—Clays were produced in 15 counties during the year. Fire clay was produced in two counties. With few exceptions all clays were used by producers for manufacturing cement, building brick, tile, and heavy clay products. Of the total clays, 362,000 tons or 41 percent was used in the manufacture of cement. Some clays were processed for producing mortar mix. Production in 1954 was 883,000 tons valued at $920,859, a 3-percent decrease from 1953 in volume and 6-percent drop in value. The average value in 1954 was $1.04 per ton.

Gypsum.—The production of crude gypsum was confined to Webster County. Four companies produced crude gypsum and operated calcining and board plants producing wallboard, lath, and prepared plasters.

Production of crude gypsum in 1954 was 1,107,000 tons, a 4-percent decrease from 1953. The value, however, increased 3 percent.

Lime.—Quicklime and hydrated lime were produced in Scott County for building, chemical, and industrial uses.

Perlite.—Perlite was expanded in Webster County by two companies and in Polk County by one company from crude material produced in Western States. The expanded product was used extensively as a lightweight aggregate in plaster and concrete. A substantial portion was used as an admixture in prepared gypsum plasters.

Sand and Gravel.—Nearly two-thirds (63) of the counties in Iowa reported production of sand and gravel in 1954. Production was up sharply over the previous year. The value of production reported by commercial operators was 49 percent greater than in 1953, and the value of noncommercial operations showed a 20-percent increase. Over 90 percent of the total production was used for building and road construction, conforming to the pattern of previous years. Table 2 shows output by class of operation and use for 1953–54. The 10 largest commercial producers were:

Automatic Gravel Products Co., Davenport.
Ervin Clark Construction Co., Logan.
Concrete Materials Co., Waterloo.
Concrete Materials & Construction Co., Cedar Rapids.
Coon Valley Gravel Co., Des Moines.
L. G. Everist, Inc., Sioux Falls, S. Dak.
Hallett Construction Co., Crosby, Minn.
Maudlin Construction Co., Webster City.
Northern Gravel Co., Muscatine.
Place Bros., Scranton.

Stone.—Limestone was produced in 56 of the State's 99 counties. Virtually all of the production was crushed for concrete aggregate, roadstone, agricultural use, riprap, fluxing stone, railroad ballast, manufacture of cement and lime, and various chemical and industrial uses. Total production in 1954 was 13,240,000 tons, of which 67 percent was used for concrete aggregate and roadstone, 10 percent for agriculture, and 20 percent for manufacturing cement and lime. Several companies operated portable and fixed plants at various

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TABLE 2.—Sand and gravel sold or used by producers, 1953–54, by classes of operations and uses

	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
COMMERCIAL OPERATIONS						
Sand:						
Building	1,553,823	$1,300,260	$0.84	2,256,138	$1,826,013	$0.81
Engine	24,488	33,192	1.36	21,898	29,247	1.34
Paving [1]	743,108	555,386	.75	1,507,739	1,170,166	.78
Railroad ballast	24,601	11,309	.46	59,821	24,122	.40
Other	82,216	62,174	.76	59,869	47,373	.79
Undistributed [2]	139,215	362,651	-------	296,756	504,777	-------
Total sand	2,567,451	2,324,972	.91	4,202,221	3,601,698	.86
Gravel:						
Building	820,812	1,221,910	1.49	1,361,033	1,807,443	1.33
Paving [1]	2,840,845	1,749,101	.62	3,356,853	2,530,925	.75
Railroad ballast	126,974	62,200	.49	119,603	81,140	.68
Other	70,549	135,940	1.93	134,583	169,614	1.26
Total gravel	3,859,180	3,169,151	.82	4,972,072	4,589,122	.92
Total sand and gravel	6,426,631	5,494,123	.85	9,174,293	8,190,820	.89
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand: Paving [1]	464,613	87,273	.19	277,831	89,837	.32
Total sand	464,613	87,273	.19	277,831	89,837	.32
Gravel:						
Building	91,000	16,000	.18	20,284	6,085	.30
Paving [1]	3,403,078	803,431	.24	2,727,248	989,788	.36
Total gravel	3,494,078	819,431	.23	2,747,532	995,873	.36
Total sand and gravel	3,958,691	906,704	.23	3,025,363	1,085,710	.36
ALL OPERATIONS						
Sand	3,032,064	2,412,245	.80	4,480,052	3,691,535	.82
Gravel	7,353,258	3,988,582	.54	7,719,604	5,584,995	.72
Grand total	10,385,322	6,400,827	.62	12,199,656	9,276,530	.76

[1] Includes materials used in bridges, culverts, etc.
[2] Includes molding, blast, and filter sand (1953); glass, molding, blast, and filter sand (1954), to avoid disclosure of individual company operations.

locations throughout the State. The 15 leading commercial producers in 1954 were:

B. L. Anderson, Inc., Cedar Rapids.
Beu & Sons Co., Grundy Center.
Concrete Materials & Construction Co., Cedar Rapids.
Ray Cook Construction Co., Ames.
Dewey Portland Cement Co., Kansas City, Mo.
Hawkeye Portland Cement Co. of Iowa, Des Moines.
Iowa Limestone Co., Des Moines.
Kaser Construction Co., West Des Moines.
Lehigh Portland Cement Co., Allentown, Pa.
Linwood Stone Products Co., Buffalo.
Gene McClain, Allerton.
Missouri Valley Limestone Co., Des Moines.
Northwestern States Portland Cement Co., Mason City.
Penn-Dixie Cement Corp., Nazareth, Pa.
River Products Co., Iowa City.

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TABLE 3.—Limestone sold and used by producers, 1953–54, by uses

	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Commercial:						
Agricultural	1,236,676	$1,574,292	$1.27	1,296,868	$1,839,798	$1.42
Dimension	4,561	23,375	5.12			
Fluxing stone	(1)	(1)		(1)	(1)	
Railroad ballast	8,185	9,822	1.20	(1)	(1)	
Riprap	480,215	621,810	1.29	192,984	239,013	1.24
Road rock and concrete aggregate	7,636,332	9,263,959	1.21	8,170,001	10,450,996	1.28
Other (filter beds, fertilizer filler, and mineral food; cement and lime, 1954)	97,791	558,367	5.71	2,897,308	3,062,684	1.06
Total commercial	9,463,760	12,051,625	1.27	12,557,161	15,592,491	1.24
Noncommercial, all uses (concrete aggregate, roadstone, riprap)	1,251,318	1,163,727	.93	682,926	795,650	1.16
Total commercial and noncommercial	10,715,078	13,215,352	1.23	13,240,087	16,388,141	1.24

[1] Bureau of Mines not at liberty to publish; included with "Other."

MINERAL FUELS

Coal.—Bituminous coal was produced from mines in 12 counties. Production of 1,197,000 tons in 1954 from mines yielding over 1,000 tons was 14 percent less than 1953 production. At the year's end, recoverable reserves of over 14 billion tons were indicated.[2]

Since 1917 Iowa's coal production has been declining. Over two-thirds of the coal produced was from strip mines. Underground mines in Appanoose, Page, and Wayne Counties employ the longwall method of mining. Table 4 lists the 10 largest producers in the State in 1954.

TABLE 4.—Ten largest coal producers in Iowa, 1954

Company	Type of operation	County	Number of men	Days	
				Per year	Average month
Wilkinson Coal Co	Strip	Marion	49	139	11.6
Beard Coal Co	do	do	13	300	25.0
Weldon Coal Co	do	do	14	278	23.2
Lovilia Coal Co	Underground	do	24	230	19.2
South Iowa Coal Co	Strip	Davis	16	243	20.3
Jude Coal Co., Inc	do	Marion	17	290	24.2
Sunshine Coal Co. No. 3	Underground	Appanoose	29	109	9.1
Angus Coal Co	Strip	Mahaska	10	293	24.4
Dennis Coal Co	do	Appanoose	15	209	17.4
Davis County Coal Co	do	Davis	3	80	6.7

Peat.—Peat was produced by the Colby Pioneer Peat Co. and Eli Colby Co. from bogs in Worth County near Hanlontown. Sales of both peat humus and peat moss were reported. Output was used principally as a soil conditioner and in the horticultural trade.

[2] Averitt, Paul, Berryhill, Louise R., and Taylor, Dorothy A., Coal Resources of the United States: Geol. Survey Circ. 293, 1954, p. 5.

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REVIEW BY COUNTIES

Adair.—Limestone for road construction and agricultural use was produced by E. F. Schildberg, Greenfield.

Adams.—Missouri Valley Limestone Co. of Des Moines produced limestone for road construction and agricultural purposes.

Allamakee.—Andrew Bresnahan, Waukon, produced limestone for road construction and agricultural use. Carlson Materials Co., Inc., of Decorah and the county highway department produced sand and gravel for road construction.

Appanoose.—Iowa Clay Products Co., Centerville, produced building brick and heavy clay products from clays mined in the area.

The longwall mining system was used in mining coal in the county. The longwall mining system relies to some extent on the crushing effect of overburden. The consumption of explosives is small and the percentage of lump coal high. The system allows virtually 100-percent recovery of coal. Nineteen coal mines, all underground except for one strip mine, were operated in the county. The following companies or mines produced coal in 1954: Appanoose Coal Co., Battle Creek Coal Co., Blue Flame Coal Co., Clark Coal Co., D. C. Coal Co., Dennis Coal Co., K & K Coal Co., Long Branch Coal Co., Monitor Coal Co., New Block Coal Co., New Diamond Coal Co., New Gladstone Coal Co., New Relay Coal Co., Old King Coal Co., Riverside Coal Co., Shamrock Coal Co., Square Deal Coal Co., Sunshine Coal Co. (two mines).

TABLE 5.—Value of mineral production in Iowa, 1953–54, by counties [1]

County	1953	1954 [2]	Minerals produced in 1954 in order of value [2]
Adair	(3)	(3)	Stone.
Adams	$250,773	(3)	Do.
Allamakee	137,895	$46,805	Stone, sand and gravel.
Appanoose	1,023,632	362,646	Stone, clays.
Audubon	49,250	(3)	Clays.
Benton	322,686	141,599	Stone, clays.
Black Hawk	2,569,832	854,651	Stone, sand and gravel.
Boone	64,445	156,263	Sand and gravel.
Bremer	93,733	354,198	Stone, sand and gravel.
Buchanan	192,031	265,482	Stone.
Buena Vista	28,181	(3)	Sand and gravel.
Butler	296,403	195,303	Stone, sand and gravel.
Calhoun	25,558	35,463	Sand and gravel.
Carroll	57,131	110,298	Do.
Cass	----------	(3)	Stone.
Cedar	121,887	(3)	Do.
Cerro Gordo	10,535,336	11,980,224	Cement, stone, sand and gravel, clays.
Cherokee	129,404	(3)	Sand and gravel.
Chickasaw	(3)	(3)	Stone.
Clay	51,122	(3)	Sand and gravel.
Clayton	(3)	525,804	Stone, sand and gravel.
Clinton	439,247	496,241	Do.
Crawford	(3)	80,151	Sand and gravel.
Dallas	126,635	171,704	Sand and gravel, clays.
Davis	491,980	----------	
Decatur	249,092	(3)	Stone.
Delaware	376,019	(3)	Do.
Des Moines	285,964	(3)	Stone, sand and gravel.
Dickinson	----------	(3)	Sand and gravel.
Dubuque	698,201	422,620	Stone, sand and gravel, lead.
Emmet	26,063	161,484	Sand and gravel.
Fayette	208,839	351,935	Stone, sand and gravel.
Floyd	115,649	166,684	Stone, clays, sand and gravel.
Franklin	120,246	214,494	Sand and gravel, clays, stone.
Fremont	284,400	281,044	Stone.
Greene	54,199	397,673	Sand and gravel.
Grundy	(3)	117,052	Sand and gravel, stone.

See footnotes at end of table.

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TABLE 5.—Value of mineral production in Iowa, 1953–54, by counties[1]—Continued

County	1953	1954 [2]	Minerals produced in 1954 in order of value [2]
Guthrie	(3)	$34,577	Sand and gravel.
Hamilton	$47,813	306,639	Do.
Hancock	77,923	139,123	Do.
Hardin	840,512	831,979	Stone, sand and gravel.
Harrison	1,003	(3)	Sand and gravel, stone.
Henry	112,620	(3)	Stone, clays.
Howard	29,181	90,354	Stone, sand and gravel.
Humboldt	144,629	(3)	Sand and gravel.
Iowa		(3)	Do.
Jackson		109,531	Sand and gravel, stone.
Jasper	11,500	(3)	Sand and gravel.
Jefferson	40,250	109,922	Stone.
Johnson	577,723	616,030	Stone, sand and gravel.
Jones	253,146	114,959	Do.
Keokuk	159,295	190,104	Stone, clays.
Kossuth	45,806	143,865	Sand and gravel.
Lee	231,766	303,500	Stone, sand and gravel.
Linn	491,578	687,451	Do.
Louisa	257,695	(3)	Stone.
Lucas	79,501		
Lyon	88,555	(3)	Sand and gravel.
Madison	221,631	833,165	Stone.
Mahaska	863,597	489,328	Stone, sand and gravel, clays.
Marion	2,847,354	407,324	Stone, sand and gravel.
Marshall	(3)	624,375	Do.
Mitchell	239,943	212,225	Do.
Monona	9,526	(3)	Sand and gravel.
Monroe	487,748		
Montgomery	(3)	(3)	Stone.
Muscatine	718,455	595,933	Sand and gravel.
O'Brien	32,620	(3)	Do.
Osceola	16,722	(3)	Do.
Page	26,536		
Palo Alto	(3)	(3)	Sand and gravel.
Plymouth	(3)	221,249	Do.
Pocahontas	(3)	(3)	Stone.
Polk	8,875,141	9,055,966	Cement, sand and gravel, stone, clays.
Pottawattamie	457,150	(3)	Stone.
Ringgold		(3)	Do.
Sac	51,702	254,137	Sand and gravel.
Scott	6,590,942	7,911,686	Cement, stone, lime, sand and gravel.
Sioux	(3)	755,144	Sand and gravel.
Story	231,487	512,669	Stone, sand and gravel, clays.
Tama	(3)	378,732	Stone, sand and gravel.
Taylor		(3)	Stone.
Van Buren	537,799	521,111	Stone, sand and gravel.
Wapello	370,331	238,345	Stone, clays.
Warren	46,985	(3)	Clays.
Washington	(3)	256,198	Stone.
Webster	3,314,656	3,481,565	Gypsum, sand and gravel, stone, clays.
Winnebago	(3)	20,227	Sand and gravel.
Winneshiek	(3)	67,925	Sand and gravel, stone.
Woodbury	225,948	319,463	Sand and gravel.
Worth	190,421	244,129	Peat, stone, sand and gravel.
Wright	61,368	116,407	Sand and gravel.
Undistributed	2,659,952	9,713,264	
Total	51,994,000	58,798,000	

[1] The following counties are not listed because no production was reported: Clarke, Ida, Mills, Poweshiek, Shelby, Union, and Wayne.
[2] Coal data not available by counties for 1954 at time of publication. Value is included with "Undistributed."
[3] Included with "Undistributed."

Limestone for road and agricultural use was produced by Concrete Materials & Construction Co., Cedar Rapids; W. P. Farnsworth, Cincinnati; and L & W Construction Co. and Porter & Magnall, both at Centerville.

Audubon.—Roxy Clay Works, Kimballton, produced clay for manufacturing heavy clay products.

Benton.—Garrison Brick & Tile Works, Garrison, produced clays for manufacturing building brick and heavy clay products.

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Limestone for riprap, road, and agricultural purposes was produced by W. E. Dake, Garrison, and Vinton Lime & Rock Co., Vinton.

Black Hawk.—Limestone for use as flux, roadstone, and agricultural purposes was produced by Beu Limestone Co., Waterloo; Concrete Materials & Construction Co., Cedar Rapids; Beu & Sons Co., Grundy Center; and Pint Soft Lime Products Co., Raymond.

Sand and gravel for building and road construction was produced by Assink Bros. and B. L. Larsen & Son, Cedar Falls; Jay B. Bagenstos & Son, La Porte City; and Concrete Materials Co., Hansen & Son Sand & Gravel, C. W. Shirey Co., and Waterloo Dredging Co., all of Waterloo.

Boone.—Sand and gravel for building and road use and railroad ballast was produced by the Chicago & Northwestern Railroad Co.; Hallet Construction Co., Crosby, Minn.; Dan Leininger, Boone; and William Mills, Madrid.

Bremer.—Agricultural limestone and limestone for road purposes were produced by Beu & Sons Co., Grundy Center; Paul Niemann Construction Co., Sumner; and Schield Soft Lime Quarry, Waverly.

Beu & Sons Co., Grundy Center; Paul Niemann Construction Co., Sumner; Nolte Bros. Sand & Gravel, Readlyn; and the county highway department produced sand and gravel for building and road construction.

Buchanan.—Limestone was produced by Aurora Limestone Products, Aurora; Concrete Materials & Construction Co., Cedar Rapids; Gene McClain, Allerton; and E. F. Patton Co., Independence. Material was used in road construction and for agriculture.

Buena Vista.—Boyer Valley Construction Co., Early, produced road gravel. Hallett Construction Co., Crosby, Minn., produced sand and gravel for building purposes.

Butler.—Greene Limestone Co., Greene; Neymeyer Lime Co., Aplington; and Shell Rock Lime Co., Inc., Shell Rock, produced limestone for road use and agricultural purposes.

Sand and gravel production was reported by Greene Limestone Co., Meyer & Muller, Waverly Gravel & Tile Co., and Charles Willeke & Sons.

Calhoun.—Gravel for road use was produced by and for the county highway department.

Carroll.—Sand and gravel for building and road construction was produced by Boyer Valley Construction Co., Earley; Carroll Sand & Gravel and Leo H. Korwes, Carroll; McClue Gravel Co., Lanesboro; and Robert H. Walters, Glidden.

Cass.—Missouri Valley Limestone Co., Des Moines, operated a quarry for the production of agricultural limestone and stone for road use.

Cedar.—Limestone for road use was produced by Concrete Materials & Construction Co., Cedar Rapids, and C. B. De Wees Construction Co., Inc., Marion.

Cerro Gordo.—Portland and masonry cement was produced at Mason City by Lehigh Portland Cement Co. and Northwestern States Portland Cement Co. These companies also produced the clay and limestone used in the manufacture of cement.

Clays for use in brick and tile were mined by Mason City Brick & Tile Co., Mason City.

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Ideal Sand & Gravel Co., Mason City, produced limestone for road and agricultural use. Frank H. Norberg Co., Denver, Colo., produced limestone for use in sugar refining.

Clear Lake Sand & Gravel Co., Inc., Clear Lake, and Ideal Sand & Gravel Co., Mason City, produced sand and gravel for building and road use.

Cherokee.—Shea Sand & Gravel Co., Cherokee, produced sand and gravel for building and road construction. Road gravel was produced for the county highway department.

Chickasaw.—Beu & Sons Co., Grundy Center, and Hewitt Bros., Fredericksburg, produced limestone for road and agricultural use.

Clay.—Stolley Construction Co. and Stolley Sand & Gravel Co., both of Spencer, produced sand for building and paving and gravel for building purposes.

Clayton.—Concrete Materials Co., Waterloo, produced molding sand from a pit near Clayton.

Limestone was produced by Harold Hartman, Earlville; H. L. Leas, Monona; and Gene McClain, Allerton. Output was used for agricultural purposes and road construction.

Clinton.—Gene McClain, Allerton, and Nichols & Schrader, Charlotte, produced limestone. It was used for rubble, roadstone, and agricultural purposes.

George Hass and Fred R. McKenzie & Co., both of Clinton, produced sand and gravel for building and road uses. Sand and gravel for road construction was produced by and for the county highway department.

Crawford.—L. J. Adams, Denison, and Mauer Construction Co., Sac City, produced sand and gravel for building and road purposes. Sand and gravel for road construction was produced by and for the county highway department.

Dallas.—Perry Sand & Gravel Co., Perry; Vanden Brink Bros., Dallas Center; and I. B. Welder, Madrid, produced sand and gravel for building and road use.

Clays for brick and tile and heavy clay products were mined by Adel Clay Products Co., West Des Moines; Redfield Brick & Tile Co., Redfield; and United Brick & Tile Co., Kansas City, Mo.

Davis.—Davis County Coal Co. and South Iowa Coal Co. operated strip mines. Shute & Lewis Coal Co. produced coal from an underground mine.

Decatur.—Grand River Limestone Co., Grand River, produced roadstone and agricultural limestone.

Delaware.—Limestone for railroad ballast, road construction, and agricultural use was produced by Beu & Sons Co., Grundy Center; Dyersville Sand & Gravel Co. of Dyersville; and Weber Dehn, Manchester.

Des Moines.—J. T. Leonard Construction Co., Columbus Junction, produced limestone for use as riprap, roadstone, and agricultural purposes.

Spring Grove Sand & Gravel Co., Burlington, produced filter sand and sand and gravel for building and paving.

Dickinson.—Concrete Sand & Materials Co., Spencer, produced sand and gravel for building and paving from a pit near Milford.

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Dubuque.—Lead concentrate containing 4 tons of recoverable lead resulting from exploration in Dubuque County in 1952 and 1953 by the Durango Mining Co. was marketed in 1954.

Dubuque Stone Products Co., Dubuque, operated a limestone quarry. The output was used for riprap, roadstone, and agricultural limestone.

Dubuque Sand & Gravel Co. and Molo Sand & Gravel Co., both at Dubuque, produced sand and gravel for building and road use.

Emmet.—Sand and gravel for building and paving use and for railroad ballast was produced by Billings Sand & Gravel and Estherville Sand & Gravel Co., both at Estherville; Dennis J. Hoien, Armstrong; and the Chicago Rock Island & Pacific R. R. and the Minneapolis & St. Louis Railway Co. Road gravel was produced by and for the county highway department.

Fayette.—Oelwein Sand & Gravel Co., Oelwein; and Reisner Sand & Gravel Co. and Carl Zupke & Son Sand & Gravel, both of Sumner, produced sand and gravel for building and road use.

Limestone for road and agricultural use was produced by Fayette Stone Co., Fayette. The county highway department reported production of limestone for road construction.

Floyd.—Rockford Brick & Tile Co., Rockford, mined clays for use in producing bricks and heavy clay products.

Limestone was produced by Walter Beine, Charles City, and Heckman-Reynolds, Inc., Floyd. It was used for road construction and agricultural purposes.

Ed Becker, Charles City, produced sand for building purposes.

Franklin.—Sheffield Brick & Tile Co., Sheffield, produced clays for manufacturing building brick, tile, and heavy clay products.

Reiken Limestone Co., Ackley, produced limestone for use as roadstone and agricultural limestone.

Beu & Sons Co., Grundy Center; Toft Sand & Gravel Co., Dows; and Weaver Construction Co., Iowa Falls, produced sand and gravel for road construction.

Fremont.—Limestone was produced by Gene McClain, Allerton, and Jack Stanley and Fred Wenke, Thurman. Material was used for road construction and agricultural purposes.

Greene.—Ferguson-Diehl Construction Co., Jefferson; Hallett Construction Co., Crosby, Minn.; and Place Bros. and Pound Construction Co., both of Scranton, produced sand and gravel for building and road use.

Grundy.—Beu & Sons Co., Grundy Center, produced limestone for road and agricultural use.

B. H. Ankes, Wellsburg, and Beu & Sons Co., Grundy Center, produced sand and gravel for building and road purposes. Gravel for road use was produced for the county highway department.

Guthrie.—K. H. Buttler, Guthrie Center, produced sand and gravel for road use.

Hamilton.—Road gravel was produced by Maudlin Construction Co., Webster City. The county highway department contracted for gravel produced in the county.

Hancock.—Sankey Sand & Gravel Co., Britt, produced sand for building purposes and gravel for building and road use. Gravel for road construction was produced by and for the county highway

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department. The Winnebago County Highway Department also produced and contracted for road gravel from pits in Hancock County.

Hardin.—Sand and gravel for building and road purposes was produced by Beu & Sons Co., Grundy Center; Clary Concrete Materials, Eldora; and Iowa Falls Sand & Gravel and George Janssen, both of Iowa Falls. Road gravel was produced under contract for the Hamilton County Highway Department.

Limestone was produced by Beu & Sons Co., Grundy Center; Iowa Limestone Co., Des Moines; and Weaver Construction Co., Iowa Falls.

Harrison.—W. A. Schemmer Co., Logan, produced limestone for road and agricultural uses.

Gravel for building and road use was produced by Ervin Clark Construction Co., Logan, and Ira E. Gorham, Pisgah.

Henry.—Winfield Brick & Tile Co., Winfield, produced clay for building brick and heavy clay products.

Limestone was produced by Kaser Construction Co. of Des Moines and the county highway department for use as riprap, road construction, and agricultural purposes.

Howard.—Bauska Construction Co., Protivin, produced limestone for road use.

Road gravel was produced by Ed Kubik and Zobeck Limestone & Gravel Co., both of Elma; and by and for the county highway department.

Humboldt.—Sand and gravel for building and road use was produced by Iowa Sand & Gravel Co., Humboldt. Road gravel was produced for the county highway department.

Iowa.—Beu & Sons Co., Grundy Center, produced sand and gravel for road construction.

Jackson.—F. J. Trenkamp Quarries, Preston, produced agricultural limestone.

Sand and gravel for building and road use, blast sand, and sand for railroad ballast was produced by the Bellevue Sand & Gravel Co., Bellevue. Schwenker Construction Co., Maquoketa, produced road gravel.

Jasper.—Newton Rock & Gravel Co., Newton; Eben Van Dusseldorp, Colfax; and Earl Wagner, Monroe, produced sand and gravel for building and road use.

Jefferson.—Triangle Construction Co., Fairfield, and the county highway department produced limestone for road and agricultural use.

Johnson.—Limestone was produced by Concrete Materials & Construction Co., Cedar Rapids, and River Products Co., Iowa City. Output was used for roadstone and agriculture.

Central Sand & Gravel Co., Iowa City, produced sand and gravel for building and road purposes.

Jones.—Iowa Road Builders, Inc., Fairmont, Minn.; Jensen Sand & Gravel, Anamosa; and Reichart Sand & Gravel Co., Monticello, produced sand and gravel for building and road purposes.

The county highway department produced limestone for road use.

Keokuk.—John Nelson & Sons, What Cheer, mined clays for use in producing heavy clay products.

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Limestone was produced by Concrete Materials & Construction Co., Cedar Rapids, and Kaser Construction Co., Des Moines, from quarries in the county. Material was used for roadstone and agricultural purposes.

Kossuth.—Road gravel was produced by the county highway department.

Lee.—Edward H. Groene, Fort Madison, and Raid Bros. Construction Co., Denmark, produced limestone for a variety of uses including riprap, roadstone, and agricultural purposes.

Jessie Thomas, Mount Pleasant, produced building and engine sand from the Standard pit. H. L. Horn, Fort Madison, reported production of building gravel.

Linn.—Concrete Materials & Construction Co. and Kings Crown Plaster Co., both of Cedar Rapids, produced sand for building and paving use and a small amount of engine sand.

Limestone was produced by Concrete Materials & Construction Co. and L. Crawford Lime Quarry Co., both of Cedar Rapids, and Dewey Robinson, Palo.

Louisa.—Limestone for riprap, road, and agricultural uses was produced by Dillon Stone Co., Columbus Junction, and Louisa County Lime Products Co., Wapello.

Lucas.—R. F. Ellis Coal Co. and Powell Coal Co. operated underground mines in the county.

Lyon.—Gravel for building purposes was produced by Hogan & Wolter, Rock Rapids, and road gravel was produced by the county highway department.

Madison.—Hawkeye Portland Cement Co. of Iowa, owned and operated by Marquette Cement Mfg. Co. of Chicago, Ill., produced limestone for the manufacture of cement at its plant in Polk County. Concrete Materials & Construction Co., Cedar Rapids, and the county highway department produced limestone for road construction.

Mahaska.—Fire clay and clays for heavy clay products and miscellaneous uses were produced. Producers include What Cheer Clay Products, What Cheer; Lost Creek Coal Co., Oskaloosa; and Mrs. Bernice McLandsborough, New Sharon.

Eight coal mines were operated in the county—7 strip mines and 1 underground. Producing mines were: Angus Coal Co., Carbon Hill Coal Co., Edward Coal Co., Hart & Mitch Coal Co., Lost Creek Coal Co., Patik Coal Co., Spring Creek Coal Co., and Star Coal Co.

Kaser Construction Co., Des Moines, produced agricultural limestone and roadstone. The county highway department produced limestone for road use.

Concrete Materials Co., Waterloo, produced glass and molding sand and gravel for building and road use from a pit near Eddyville. E. Groenendyk, Bussey, produced gravel for building purposes.

Marion.—In 1954 Marion was the leading coal-producing county in Iowa. Twenty mines were operated, 14 of these were strip mines and 6 underground. Operators in 1954 included Beard Coal Co., Big Ben Coal Co., Husted Bros. Coal Co., Liberty Coal & Mining Co., Liter Coal Co., Nicolas Coal Co., Ver Steeg Coal Co., and Wilkinson Coal Co., all of Knoxville; Cedar Creek Coal Co., Lovilia; De Nicola Coal Co., Oskaloosa; Jude Coal Co., Inc. and Lovilia Coal Co., Bussey; Kirkville Coal Co., Riggen Coal Co., Weldon Coal Co.,

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Harvey; C. N. Knox Coal Co., Hamilton; Moon & Son Coal Co., Attica; Newton Coal Co., Pella; Ruby Coal Co., Otley; and Twin City Coal Co., Dallas.

Limestone was produced by C. D. Hess & Son Rock Material Co., Lacona; Kibbey Limestone Co., Carlisle; and Pella Limestone Co., Pella.

Russell Kintz, Colfax, produced sand and gravel for building purposes.

Marshall.—Concrete Materials & Construction Co., Cedar Rapids; Empire Sand & Material Co., Marshalltown; and the Minneapolis & St. Louis Railway Co., produced sand and gravel for building and road use and railroad ballast.

Concrete Materials & Construction Co. produced roadstone.

Mitchell.—L. R. Falk, St. Ansgar, and Edd Kollman, Osage, produced limestone.

L. H. Decklever Sand & Gravel and Seeber & Wetter, both of Osage, and L. R. Falk Construction Co., St. Ansgar, produced building sand and gravel and gravel for road purposes.

Monona.—Road gravel was produced by the Schemer Construction Co., Logan, and for the county highway department.

Monroe.—Coal was produced by the following companies operating underground mines: Acme Coal Co., Lovilia; Avery Coal Co., Avery; Karpan Coal Co., Maple Coal Co., Union Coal Co., White Oak Coal Co., all of Albia; Lovilia Coal Co., Bussey; and O'Brien Coal Co. of Des Moines. The Halverson Coal Co., Oskaloosa had a strip operation.

Montgomery.—Kaser Construction Co. and Missouri Valley Limestone Co., both of Des Moines, operated limestone quarries in the county.

Muscatine.—Automatic Gravel Products Co., Davenport, and Hahn Bros. Sand & Gravel Co. and Northern Gravel Co., both of Muscatine, produced sand and gravel for building and road uses. Blast, engine, and filter sand also was produced.

O'Brien.—Bruegman Gravel Co. produced sand and gravel for building purposes at Hartley.

Osceola.—Sand and gravel for building and road use was produced by Hallett Construction Co., Crosby, Minn., and Van Drie Construction Co., Ocheyedan. Sand and gravel for road purposes was produced for the county highway department.

Page.—McKinley Coal Co., Villisca, operated an underground mine.

Palo Alto.—Gravel for building and road purposes was produced by Bauck Construction Co., Emmetsburg, and John Durweiler Sand & Gravel Co., West Bend.

Plymouth.—Sand and gravel for building purposes was produced by Higman Sand & Gravel Co., Akron, and Wiltgen Ready Mix Concrete Co., Le Mars. The county highway department produced road gravel.

Pocahontas.—Midwest Limestone Co., Inc., Gilmore City, produced limestone for use as riprap, roadstone, and for agricultural purposes.

Polk.—Hawkeye Portland Cement Co. of Iowa, Des Moines, and Penn-Dixie Cement Corp., West Des Moines, produced portland and

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masonry cement. Limestone and clay for use in manufacturing cement also were produced.

Clays were mined by Des Moines Clay Co., Goodwin Tile & Brick Co., and Iowa Pipe & Tile Co., all of Des Moines, and United Brick & Tile Co., Kansas City, Mo. Clays were used for brick, heavy clay products, mortar mix, and fire clay.

Hopkins Coal Co., Colfax, operated a strip mine.

Sand and gravel producers in Polk County include: Bishop Sand & Gravel Co., Mitchellville; Breeden Sand & Gravel Co., Coon Valley Gravel Co., and Keefner Sand & Gravel Co., all of Des Moines; Concrete Materials Co., Waterloo; Hallett Construction Co., Crosby, Minn.; J. W. Lehman, Sheldahl; West Des Moines Sand Co., West Des Moines; and the Des Moines city engineer. Principal uses were for building and road construction. Some engine and filter sand also was produced.

Pottawattamie.—Missouri Valley Limestone Co., Des Moines, operated quarries for producing roadstone and agricultural limestone.

Ringgold.—Concrete Materials & Construction Co., Cedar Rapids, produced limestone for road use.

Sac.—Hallett Construction Co., Crosby, Minn., and Fred Wirtjers, Sac City, produced sand and gravel for building and road purposes. Sand for road use was produced for the county highway department.

Scott.—Dewey Portland Cement Co., Davenport, produced portland and masonry cement, as well as clay and limestone, for use in manufacturing cement.

Linwood Stone Products Co., Buffalo, produced lime for building, chemical, and industrial uses, as well as limestone for a variety of purposes.

Le Claire Quarries, Inc., Le Claire, and the county highway department produced limestone for road use and riprap.

Builders Sand & Gravel Co., Davenport, produced sand and gravel for building purposes.

Sioux.—Sand and gravel was produced by L. G. Everist, Inc., Sioux Falls, S. D.; Floyd Gravel Co., Orange City; Hawarden Gravel Co., Hawarden; Rock Valley Cement Block & Tile Co., Rock Valley; and Roos Sand & Gravel, Boyden. Principal uses were for building and road construction and railroad ballast.

Story.—Nevada Brick & Tile Co., Nevada, mined clays for use in making building brick and heavy clay products.

Concrete Materials & Construction Co., Cedar Rapids, and Ray Cook Construction Co., Ames, produced limestone.

Ray Cook Construction Co. and Roberson Bros., both of Ames, and Glenn W. Hankins, Nevada, produced sand and gravel for building and road uses.

Tama.—Limestone was produced by Concrete Materials & Construction Co., Cedar Rapids, and Joseph Wenke, Toledo.

Flint Crushed Gravel Co., Des Moines, produced sand and gravel for building and road purposes from a pit near Tama.

Taylor.—Missouri Valley Limestone Co., Des Moines, produced limestone for road and agricultural uses.

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Van Buren.—Valley Limestone & Gravel, Inc., Farmington, produced sand and gravel for road purposes.

Coal was produced by strip mining by Hamlin Bros. Coal Co. and Van Patton & Son Coal Mine, Bonaparte, and Laddsdale Coal Co., Eldon.

Limestone was produced by Douds Stone, Inc., from an underground deposit and from quarries by Kaser Construction Co., Des Moines; Gene McClain, Allerton; Triangle Construction Co., Fairfield; and the county highway department. Output was used for road construction, riprap, and agricultural purposes.

Wapello.—Ottumwa Brick & Tile Co., Ottumwa, mined clays for use in manufacturing building brick and heavy clay products.

Engness Coal Co., Oskaloosa; Lanning Coal Co., Kirkville; and Munterville Coal Co., Ottumwa, operated strip mines. New Globe Co., Ottumwa, operated an underground mine.

Limestone was produced by Kaser Construction Co., Des Moines, and Wapello Stone Quarries, Ottumwa.

Warren.—Carlisle Brick & Tile Co., Carlisle, mined clays for use in brick and heavy clay products.

S & R Coal Co., Carlisle, was an underground operation.

Washington.—Limestone for roadstone and agricultural use was produced by Concrete Materials & Construction Co., Cedar Rapids; Hayes Quarry, Washington; and Kaser Construction Co., Des Moines.

Wayne.—Enterprise Coal Co., Promise City, operated an underground coal mine.

Webster.—Clays were mined by Johnston Clay Works, Inc., Kalo Brick & Tile Co., Lehigh Sewer Pipe & Tile Co., and Vincent Clay Products Co., all at Fort Dodge. Output was used in making brick, heavy clay products, and mortar mix.

Crude gypsum was produced in the Fort Dodge area by Celotex Corp., Certain-Teed Products Corp., National Gypsum Co., and United States Gypsum Co., all of whom operated plants for processing the material. National Gypsum Co. and United States Gypsum Co. also expanded perlite for manufacturing lightweight plaster mixes.

Limestone was produced from an underground deposit by the Fort Dodge Limestone Co.

Derrald Carlson, Dayton; Casey Sand & Gravel and W. L. Goodrich, both of Lehigh; and Fort Dodge Sand & Gravel Co., Fort Dodge, produced sand and gravel for building and road purposes. Road gravel was produced by and for the Webster County, Calhoun County, and Hamilton County Highway Departments.

Winnebago.—Gravel for road construction was produced by and for the county highway department.

Winneshiek.—Carlson Materials Co., Inc., and Decorah Concrete Products Co., both of Decorah, produced sand and gravel for building and road purposes.

Bruening Rock Products, Inc., Decorah, produced limestone for road use and agricultural purposes.

Woodbury.—Sand and gravel, chiefly for building and paving use and for railroad ballast, was produced by Concrete Materials Co., Waterloo; Thomas Flewelling, Moville; and Kudron Construction Co., Sioux City.

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Worth.—Limestone Products Co., Fertile, produced limestone for road and agricultural use.

Peat was produced by Colby Pioneer Peat Co. and Eli Colby Co., both at Hanlontown.

L. R. Falk Construction Co., St. Ansgar, produced gravel for road construction.

Wright.—Oscar Nelson, Belmond, and Pinkham Sand & Gravel Corp., Goldfield, produced sand and gravel for building and road construction. Some glass sand also was produced. The county highway department produced road gravel.

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The Mineral Industry of Kansas

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the State Geological Survey of Kansas.

By Robert S. Sanford,[1] W. G. Diamond,[2] and Walter H. Schoewe[3]

KANSAS in 1954 ranked among the first 10 States in the United States in value of mineral output, totaling a record $450 million, 9 percent more than the 1953 record. There were 21 minerals and mineral fuels produced in the State, the 5 principal minerals, in the order of value, being petroleum, natural gas, cement, stone, and natural-gas liquids. Of the 105 counties in Kansas, 101 reported mineral production in 1954.

Some of the production data for 1954 were collected jointly with the Bureau of the Census, United States Department of Commerce. Production totals will be compared with Census totals when they are available, and differences will be adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

Oil and natural gas remained the State's most important minerals in value. Oil was produced in 71 counties and natural gas in 48 counties in 1954. More than 85 percent of the natural gas came from the famous Hugoton field in the southwestern part of Kansas. There were 122 oil and 22 gas pools discovered, and 2 previously abandoned oil pools and 2 gas pools were revived.[4] Oil, natural gas, and related hydrocarbon commodities produced in 1954 totaled approximately 87 percent of the total mineral value in the State, nonmetals, 12 percent, and metals, 1 percent. Metal output was centered in Cherokee County in the southeastern part of the State, which is part of the important Tri-State zinc-lead mining district. Nonmetal production was reported from 93 counties.

EMPLOYMENT IN THE MINERAL INDUSTRIES

Employment.—Average annual employment in the Kansas mineral industries in 1954 approximated that in 1953. Average employment in the metallic and nonmetallic industries decreased, while the average for the oil and gas industry increased to 16,000 and 87 percent of the State total, according to the Employment Security Division, Labor Department, State of Kansas.

Accidents.—For the fifth consecutive year, no fatal accidents were reported in the Kansas coal industry. The oil and gas industry

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[4] Ver Wiebe, W. A., Goebel, E. D., Hornbaker, A. L., and Jewett, J. M., Oil and Gas Developments in Kansas During 1954: State Geol. Survey of Kansas, Bull. 112, September 1955, p. 7.

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TABLE 1.—Mineral production in Kansas, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement [2]—376-pound barrels	8,546,250	$21,428,536	9,076,328	$23,874,179
Clays	670,694	749,579	(3)	(3)
Coal	1,715,004	7,101,386	1,372,294	5,602,808
Helium—cubic feet	42,782,800	563,923	37,530,000	593,163
Lead (recoverable content of ores, etc.)	3,347	876,914	4,033	1,105,042
Natural gas—million cubic feet	420,607	36,172,000	412,369	43,711,000
Petroleum (crude)—thousand 42-gallon barrels	114,566	308,180,000	119,317	335,280,000
Pumicite	(3)	(3)	23,433	92,899
Salt (common)	905,227	7,480,556	876,667	7,778,406
Sand and gravel	8,728,291	5,668,308	10,421,554	7,194,171
Stone	8,769,152	11,303,950	10,377,008	12,941,822
Zinc (recoverable content of ores, etc.)	15,515	3,568,450	19,110	4,127,760
Undistributed: Natural cement, gypsum, natural-gas liquids, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		[4] 10,137,870		9,721,342
Total Kansas		413,231,000		[5] 449,587,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes natural cement, value for which is included with "Undistributed."
[3] Value included with "Undistributed."
[4] Excludes value of clays used for cement.
[5] Total adjusted to eliminate duplication in value of clays and stone.

reported 5 fatal or permanent-disability accidents in 1954—3 in production, 1 in pipeline construction, and 1 not classified.

Wages.—The 1954 average hourly and weekly earnings in the mineral industries increased slightly over 1953, continuing the upward trend in wages in recent years, according to the Employment Security Division, Labor Department, State of Kansas. This was due mainly to the upward trend in wages in the oil and gas industry, the dominant mineral industry in the State.

TABLE 2.—Average annual employment of mining industries, 1945–49 (average) and 1950–54 [1]

Industry	1945–49 (average)	1950	1951	1952	1953	1954
Oil and gas	12,600	13,900	15,200	15,900	15,900	16,000
Coal mining	1,120	900	800	700	500	500
Metal mining	1,200	700	800	600	400	300
Nonmetal mining	1,300	1,700	1,700	1,700	1,700	1,600
Total	16,220	17,200	18,500	18,900	18,500	18,400

[1] Employment Security Division, Labor Department, State of Kansas.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Since 1917, the mineral fuels—oil, gas, natural gasoline, liquefied petroleum gases, and coal—have contributed the greatest share to the mineral wealth of Kansas. The mineral fuels furnished 87 percent of the value of all minerals produced in 1954.

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Coal.—Kansas production of coal in 1954 (totaling 1.4 million tons and valued at $5.6 million) decreased 20 percent in quantity and 21 percent in value from 1953. Among the minerals produced in the State, coal ranked seventh in value. Production by strip mining has gained steadily from approximately 95 percent of all coal mined in the State in 1950 to slightly more than 98 percent in 1954.[5] Coal was mined in 8 counties, with Cherokee, Crawford, and Linn producing 98 percent of the total.

TABLE 3.—Coal production, 1945–49 (average) and 1950–54

Year	Number of mines			Short tons	Value	
	Underground	Strip	Total		Total	Average per ton
1945–49 (average)	57	33	90	2,607,127	$8,405,766	$3.22
1950	48	32	80	2,124,980	8,233,527	3.87
1951	22	46	68	1,961,101	7,734,478	3.94
1952	15	32	47	2,028,601	7,902,590	3.90
1953	28	21	49	1,715,004	7,101,386	4.14
1954	10	30	40	1,372,294	5,602,808	4.08

Helium.—The Otis helium plant, operated by the Federal Bureau of Mines in Rush County, produced 37.5 million cubic feet of helium valued at $593,000, a 12-percent decrease in quantity but a 5-percent increase in value over 1953. Helium is extracted from natural gas.

Natural Gas.—Kansas ranked fifth in the Nation in the market value of natural gas. Gas marketed in 1954 was 412,369 million cubic feet valued at $43.7 million, a decrease of 2 percent in quantity and an increase of 21 percent in value from 1953. In addition, 2,203 million cubic feet of gas was used for repressuring, and 47,428 million cubic feet was vented. Production originated in 48 counties; the leaders, in order of highest production, were Stevens, Grant, Kearny, Morton, and Finney. In all, 370 wells producing gas were drilled in Kansas in 1954, an increase of 257 over 1953. During the year 22 new gas pools were discovered, and 2 abandoned gas pools were revived. Estimated proved recoverable reserves of natural gas in Kansas were reported by the Committee on Natural Gas Reserves of the American Gas Association to be 15,758 billion cubic feet in 1954.

TABLE 4.—Marketed production of natural gas, 1945–49 (average) and 1950–54

Year	Million cubic feet	Value	Year	Million cubic feet	Value
1945–49 (average)	212,054	$10,892,000	1952	412,544	$34,241,000
1950	364,024	24,026,000	1953	420,607	36,172,000
1951	417,538	33,821,000	1954	412,369	43,711,000

[5] Schoewe, Walter H., The Mineral Industry of Kansas, 1950–1954: State Geol. Survey of Kansas, Bull. 119, Part 4, July 1956, pp. 105–174.

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TABLE 5.—Gross withdrawals and disposition of natural gas, 1950–54, in million cubic feet

Year	Withdrawals [1]			Disposition		
	From gas wells	From oil wells	Total	Marketed production [2]	Repressuring	Vented and wasted [3]
1950	311,400	89,300	400,700	364,024	1,352	35,324
1951	379,500	80,700	460,200	417,538	1,401	41,261
1952	382,000	80,300	462,300	412,544	1,197	48,559
1953	415,000	60,000	475,000	420,607	1,079	53,314
1954	390,000	72,000	462,000	412,369	2,203	47,428

[1] Marketed production plus quantities used in repressuring, vented, and wasted.
[2] Comprises gas sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas in pipelines.
[3] Includes direct waste on producing properties and residue blown to air. (Partly estimated.)

The Federal Power Commission granted the Panhandle-Eastern Pipe Line Co. permission to begin construction of a $22.9 million extension to its main transmission lines that deliver gas from the Southwest to the Midwestern States. Panhandle-Eastern's pipeline crosses Kansas on an approximate line from Liberal, Seward County; through Greensburg, Kiowa County; Olpe, Lyon County; and Louisburg, Miami County. The estimated cost of the new pipelines in the State is $7.3 million. The company also planned to spend $9.5 million for added power to its compressor stations and another $11.4 million for new wells and gathering lines in the Hugoton gas field. During the last months of 1954 considerable drilling activity centered in Barber, Harper, and Kingman Counties, where numerous oil and gas discoveries were made. Texas oil interests planned a new 125-mile gas pipeline from Barber County to Wichita, Sedgwick County.

Cities Service Pipe Line Co. was conditioning the depleted McLouth gas field near McLouth, Jefferson County, for underground storage of natural gas. The project when completed will cost an estimated $4 million. In May the Halliburton Oil Well Cementing Co. began to construct its $40,000 cement-blending plant in Hugoton, Stevens County.

TABLE 6.—Gas-pipeline construction, 1954 [1]

Company	Origin (county)	Terminal (county)	Length, miles	Diameter, inches	Status
Northern Natural Gas	Clark	Clark	12.6	30	Completed.
Do	Kiowa	Edwards	14.2	30	Do.
Do	do	Kiowa	4.8	3	Do.
Do	Comanche	Comanche	2.9	3	Do.
Do	Haskell	Haskell	3.0	4	Do.
Do	Kearny	Kearny	1.5	6	Do.
Do	do	do	1.3	4	Do.
Do	do	do	1.1	4	Do.
Do	do	do	1.3	4	Do.
Do	Finney	Finney	1.5	4	Do.
Hugoton Production	Stevens	Stevens	1.5	6	Building.
Panhandle-Eastern	Morton	Texas (Okla.)	20.9	24	Completed.
Do	Ford	Ford	3.3	6	Do.
Do	do	do	3.1	4	Do.

[1] National Oil Scouts and Landmen's Association, Oil-and Gas-Field Development in the United States: 1954, Austin, Tex.

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Natural-Gas Liquids.—Production of natural-gas liquids decreased 6 percent in quantity and 17 percent in value from 1953. The 14 active natural-gasoline plants in Kansas operated at a daily capacity of 417,000 gallons of natural gasoline and 330,000 gallons of butane and lighter fuels.[6] Proved recoverable reserves of natural-gas liquids were estimated at 175,197,000 barrels, down 1 percent from 1953 estimates.[7]

TABLE 7.—Natural-gas liquids produced, 1945–49 (average) and 1950–54

Year	Natural gasoline		LP-gases		Total	
	M gal.	Value	M gal.	Value	M gal.	Value
1945–49 (average)	70,015	$4,060,400	24,627	$940,800	94,642	$5,001,200
1950	108,024	6,146,000	46,830	1,487,000	154,854	7,633,000
1951	111,090	6,931,000	68,082	2,445,000	179,172	9,376,000
1952	115,206	7,286,000	77,406	3,116,000	192,612	10,402,000
1953	(1)	(1)	(1)	(1)	(1)	(1)
1954	(1)	(1)	(1)	(1)	(1)	(1)

[1] Figure withheld to avoid disclosure of individual company operations.

TABLE 8.—Capacity of natural-gasoline plants, 1954, gallons per day [1]

Company	Location		Natural-gasoline capacity	Butane- and lighter-fuels capacity
	Nearest town	County		
Cities Service Oil Co. (Del.)	Wichita	Sedgwick	58,000	36,000
Do	Burrton	Reno	11,000	11,000
Colorado Interstate Gas Co., Inc	Lakin	Kearny	40,000	----------
Deerfield Petroleum, Inc	Deerfield	do	14,183	7,335
Flynn Oil Co	Otis	Rush	5,500	400
Hugoton Production Co	Ulysses	Grant	29,000	43,000
Kansas Power & Light Co	Medicine Lodge	Barber	15,000	----------
Magnolia Petroleum Co	Ulysses	Grant	16,670	13,200
Northern Natural Gas Co	Sublette	Seward	57,935	----------
Do	Holcomb	Finney	11,232	----------
Panhandle-Eastern Pipe Line Co	Liberal	Seward	48,450	19,012
Skelly Oil Co	Cunningham	Kingman	[2] 20,000	----------
Stanolind Oil & Gas Co	Ulysses	Grant	86,000	197,000
The Texas Co	Burden	Cowley	4,500	2,900
Total			417,470	329,847

[1] Oil and Gas Journal, Apr. 26, 1954, p. 200.
[2] Combined natural gasoline and LP-gas.

Petroleum.—Kansas established a new crude-oil production record of 119 million barrels in 1954 and ranked as the fifth largest producer in the Nation. The 1954 output increased in value to $335.3 million, a 9-percent gain over 1953, owing partly to price but mainly to the 4-percent increase in production. During the year 122 new oil pools were discovered, and 2 abandoned pools were revived. The most significant oil-pool discoveries were in Morton, Harper, Haskell, Kingman, and Sedgwick Counties. The industry drilled 1,176 exploratory wells in 1954, of which 234 produced oil and 45 produced gas. This

[6] Oil and Gas Journal, vol. 52, No. 51, Apr. 26, 1954, p. 200.
[7] American Gas Association, Gas Facts: 1954, 272 pp.

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represents a discovery success of 24 percent in the State, compared with 17 percent for the previous year. As in 1953, Barton County was the foremost oil producer, followed by Ellis, Russell, Butler, and Rice Counties. The major oil fields in Kansas were Trapp, Kraft-Prusa, Hall-Gurney, Chase-Silica, El Dorado, and Bemis-Shutts. These fields produced over 20 percent of the annual State production.[8] Active oil wells in the State totaled 37,755, an increase of 7 percent over 1953, and the average output per well of 8.9 barrels per day was slightly less than the 1953 average of 9.1 barrels per day. The average price per barrel advanced to $2.82 in 1954 from the 1953 average of $2.69. Proved recoverable reserves of crude oil in Kansas were estimated at 978 million barrels, a 7-percent gain over 1953, according to the API Committee on Petroleum Reserves.

The daily crude-oil capacity of the 14 refineries and cracking plants in Kansas at the year end was 262,750 barrels operating, 5,250 barrels not operating, and 2,500 barrels building. The capacity of cracking plants was 81,691 barrels operating, 9,150 barrels not operating, and 10,000 barrels building. Shallow Water Refining Co. in Scott County closed down September 1, with the expectation of resuming operations on March 1, 1955. Chanute Refining Co. of Chanute, Neosho County, was purchased by Brown-Strause Corp. of Kansas City, a structural-steel and allied-industries firm. The refinery processed about 1,000 barrels of oil daily.

Arapahoe Pipe Line Co. began construction of a 494-mile, 20-inch pipeline from the Julesburg area in Colorado to the main trunkline of Sinclair Pipeline Co., at Humboldt, Allen County. A new operations office, established by Sinclair at Great Bend, will supervise the company gathering system for western Kansas. Western Pipe Line Co., a subsidiary of Service Pipe Line Co., started construction of a 20- to 23-inch pipeline that extends from Fort Laramie, Wyo., across Kansas, to Freeman, Mo. Shamrock Oil & Gas Corp. completed a pipeline from the Novinger field in Meade County to connect to its Texas Panhandle line, which supplies its refinery at Shamrock, Tex.

TABLE 9.—Production of crude petroleum, 1945–49 (average) and 1950–54

Year	Thousand barrels	Value		Year	Thousand barrels	Value	
		Total	Average per barrel			Total	Average per barrel
1945–49 (average)	102,308	$202,330,000	$1.98	1952	114,807	$293,910,000	$2.56
1950	107,586	276,500,000	2.57	1953	114,566	308,180,000	2.69
1951	114,522	294,320,000	2.57	1954	119,317	335,280,000	2.81

[8] Work cited in footnote 4.

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TABLE 10.—Production of crude petroleum, 1950–54, by fields, in thousand barrels

[Oil and Gas Journal]

Field	1950	1951	1952	1953	1954
Bemis-Shutts	4,681	4,287	3,741	3,526	3,549
Bloomer	2,716	2,782	2,344	2,067	1,589
Burnett	2,747	3,044	2,709	[1] 2,303	2,170
Burrton-Haury	1,127	1,026	909	781	809
Chase	3,078	2,786	[2] 7,152	[2] 6,007	[2] 5,339
El Dorado	3,019	3,202	3,454	3,939	3,864
Fairport	1,243	1,135	879	834	823
Geneseo-Edwards	2,960	3,001	3,304	3,061	2,869
Gorham	1,406	2,452	1,990	1,793	1,692
Hall-Gurney	3,159	3,637	3,954	4,640	4,528
Iuka-Carmi	[3]	1,104	1,244	1,314	1,421
Kraft-Prusa	5,870	6,326	5,449	4,721	4,357
Marcotte	[3]	399	1,964	1,831	1,681
Morel	1,337	2,301	2,092	1,798	1,654
Ray	1,484	1,822	1,624	1,393	1,280
Seeley-Wick	956	760	1,292	1,753	1,798
Silica-Raymond	5,147	4,950	[3]	[3]	[3]
Stoltenberg	1,962	1,760	1,471	1,270	1,119
Thrall-Aagard	615	1,324	1,650	1,121	1,002
Trapp	8,645	7,686	6,469	6,081	5,461
Welch-Bornholdt	[3]	[3]	740	1,259	1,361
Other fields	55,068	58,334	60,414	[4] 63,767	[4 5] 70,951
Total	107,220	114,118	114,845	[4] 115,259	[4 5] 119,317

[1] Revised figure.
[2] Silica included with Chase.
[3] Included with "Other fields."
[4] Bureau of Mines data.
[5] Final figures.

TABLE 11.—Indicated demand for crude petroleum, by months, 1954

Month	Thousand barrels	Month	Thousand barrels
January	8,958	August	9,845
February	8,748	September	9,519
March	11,006	October	9,468
April	9,417	November	9,805
May	10,788	December	10,108
June	10,254		
July	10,584	Total	118,500

TABLE 12.—Production of crude petroleum, by months, 1954

Month	Thousand barrels	Month	Thousand barrels
January	9,437	August	9,938
February	9,199	September	9,642
March	10,438	October	9,951
April	10,107	November	9,908
May	10,218	December	10,082
June	10,093		
July	10,304	Total	119,317

TABLE 13.—Sales of petroleum products, 1950–54, in thousand barrels

Product	1950	1951	1952	1953	1954
Gasoline	17,463	18,723	19,798	21,004	23,259
Kerosine	1,030	1,344	1,290	1,100	1,068
Range oil	592	906	916	880	893
Distillate fuel oil	4,527	5,552	5,695	5,938	5,897
Residual fuel oil	5,835	7,068	6,062	5,247	4,020

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TABLE 14.—Capacity of petroleum refineries and cracking plants, Jan. 1, 1955

[Barrels per day]

Company	Location	County	Crude-oil capacity			Cracked-gasoline capacity		
			Operating	Shut down	Building	Operating	Shut down	Building
Anderson-Prichard Oil Corp.	Arkansas City	Cowley	13,000	2,000		2,550	3,950	
Century Refining Co., Inc.	Shallow Water	Scott	1,500	2,500			1,250	
The Chanute Refining Co.	Chanute	Neosho	750	750		750	750	
Cooperative Refinery Assoc.	Coffeyville	Montgomery	24,500			2,800	2,400	
Do	Phillipsburg	Phillips	8,000			1,900		
Derby Oil Co	Wichita	Sedgwick	16,000			4,661		
El Dorado Refining Co.	El Dorado	Butler	12,500		2,500	5,000	800	
M. F. A. Oil Co	Chanute	Neosho	2,000			400		
National Cooperative Refinery Assoc.	McPherson	McPherson	26,000			6,600		
Phillips Petroleum Co	Kansas City	Wyandotte	52,000			16,000		
Skelly Oil Co	El Dorado	Butler	45,000			19,000		7,500
Socony-Vacuum Oil Co., Inc.	Augusta	do	28,500			9,030		2,500
Standard Oil Co. (Ind.)	Neodesha	Wilson	21,000			7,000		
Vickers Petroleum Co., Inc.	Potwin	Butler	12,000			6,000		
			262,750	5,250	2,500	81,691	9,150	10,000

TABLE 15.—Petroleum pipeline construction, 1954[1]

Company	Origin (county)	Terminal (county)	Length, miles (Kansas)	Diameter, inches
Socony-Vacuum	Graham	Trego	12	4
Do	Graham	Graham	10	6
Arapahoe	Cheyenne (Sterling, Colo.)	Allen (Humboldt, Kans.)	400	20
Western	Rawlins (Wyoming)	Miami (Freeman, Mo.)	425	22
Shamrock	Meade	Meade (Shamrock, Tex.)	15	6

[1] National Oil Scouts and Landmen's Association, Oil- and Gas-Field Development in the United States: Austin, Tex., 1954, p. 270.

TABLE 16.—Oil- and gas-well drilling, 1954, by counties[1]

County	Proved field wells			Exploratory wells			Total			Grand total
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	
Barber	45	7	11	8	12	30	53	19	41	113
Barton	164		91	22	2	35	186	2	126	314
Butler	153		56	4		31	157		87	244
Chase						1			1	1
Cheyenne						1			1	1
Clark	13	2	2	4	3	3	17	5	5	27
Coffey	3					5	3		5	8
Comanche			2			5			7	7
Cowley	210	8	104	10		63	220	8	167	395
Decatur	13		9			16	13		25	38
Dickinson	8		2	1		11	9		13	22
Doniphan						1			1	1
Edwards	4	3		1	3	13	5	6	13	24
Elk						1			1	1
Ellis	133		106	17		54	150		160	310
Ellsworth	16		19	2		7	18		26	44
Finney	6	67	5	2	2	2	8	69	7	84

See footnote at end of table

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TABLE 16.—Oil- and gas-well drilling, 1954, by counties[1] —Continued

County	Proved field wells			Exploratory wells			Total			Grand total
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	
Ford			1		1			1	1	2
Gove				1		2	1		2	3
Graham	147		56	10		54	157		110	267
Grant		4			1			5		5
Gray						2			2	2
Greeley						4			4	4
Greenwood	106		41	4		22	110		63	173
Hamilton		4	1			2		4	3	7
Harper	32	2	8	13		18	45	2	26	73
Harvey	8		4			3	8		7	15
Haskell		40	1	1		2	1	40	3	44
Hodgeman						6			6	6
Jackson						1			1	1
Jewell			1						1	1
Kearny		43	4					43	4	47
Kingman	70	2	6	9	4	21	79	6	27	112
Kiowa					1	3		1	3	4
Lane						2			2	2
Lincoln						1			1	1
Logan						3			3	3
Lyon	22		3	1		4	23		7	30
McPherson	114	1	32	4		28	118	1	60	179
Marion	26		15	3		16	29		31	60
Marshall			1			1			2	2
Meade	2	2	4	1	1	2	3	3	6	12
Morris	4		2	1		2	5		4	9
Morton	3	43	4	1	1	1	4	44	5	53
Ness	4		2	1		4	5		6	11
Norton	81		11	2		36	83		47	130
Osage						1			1	1
Osborne						2			2	2
Ottawa						1			1	1
Pawnee	68	6	14	12	3	44	80	9	58	147
Phillips	6			2		6	8		6	14
Pratt	43		24	11	1	26	54	1	50	105
Rawlins						4			4	4
Reno	13		6	3		16	16		22	38
Rice	114	2	39	4		14	118	2	53	173
Rooks	128		82	10		43	138		125	263
Rush	11	1	9	3	1	17	14	2	26	42
Russell	157	2	56	5		21	162	2	77	241
Saline	16		9			8	16		17	33
Scott				1		1	1		1	2
Sedgwick	25		24	5		22	30		46	76
Seward	2	39	3		6	5	2	45	8	55
Shawnee						1			1	1
Sheridan	5		5	1		6	6		11	17
Smith						2			2	2
Stafford	102		78	26	1	67	128	1	145	274
Stanton		24	3		1	4		25	7	32
Stevens		21			1			22		22
Sumner	74	2	27	20		28	94	2	55	151
Thomas				1		6	1		6	7
Trego	17		12	5		25	22		37	59
Wabaunsee						4			4	4
Wallace						1			1	1
Wichita						1			1	1
Wilson				1			1			1
Woodson	29		6	1		2	30		8	38
Total: 1954	2,197	325	1,001	234	45	897	2,431	370	1,898	4,699
1953	1,913	77	1,163	180	36	1,027	2,093	113	2,190	4,396

[1] National Oil Scouts and Landmen's Association, Oil-and-Gas Field Development in the United States: vol. 25, 1955, Austin, Tex.

METALS

Lead- and zinc-mine production in Kansas, after declining in 1952–53, increased in 1954, although total mine production for the Nation decreased slightly. United States stocks of lead held at primary smelters and refineries totaled 78,900 tons on December 31, 1954, compared

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with the January 1, 1954, total of 65,000 tons. United States stocks of zinc on hand at zinc-reduction plants totaled 120,500 tons at the end of 1954, compared with 180,000 at the end of 1953.

Cadmium, Germanium, Gallium, and Indium.—Trace elements of these minor metals occur in the lead-zinc ores of Kansas and are recovered as byproducts from flue dusts of zinc-smelting operations. The origin of these minor metals is indeterminate, as the source is an accumulation of both domestic and foreign concentrates, which are not analyzed individually for the trace elements.

Lead.—Mine production of recoverable lead increased 20 percent to 4,033 tons, and value increased 26 percent to $1.1 million, as base-metal prices improved after a steady decline until late in 1953. The five major lead producers in 1954 were the Eagle-Picher Co., National Lead Co., Mid Continent Lead & Zinc Co., Wilbur Mining Co., and Harris Mining Co. Lead metal opened in 1954 at 13½ cents per pound (New York), dropped to a low of 12½ cents in February, then gradually rose to 15 cents in October, where the price stayed for the remainder of the year. The Government purchase program of lead and zinc for the stockpile, which started in June under the General Services Administration, was largely responsible for the recovery of the price of lead.

The Eagle-Picher lead smelter at Galena, Cherokee County, was active in 1954.

TABLE 17.—Mine production of lead and zinc, 1945-49 (average), 1950-54, and total 1876-1954, in terms of concentrates and recoverable metals[1]

Year	Mines producing	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content[2]			
						Lead		Zinc	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945-49 (average)	78	10,420	$1,898,271	75,055	$7,471,141	7,852	$2,172,174	40,521	$9,915,058
1950	66	12,218	1,833,537	50,579	4,581,839	9,487	2,561,490	72,176	7,717,984
1951	78	11,920	2,582,335	53,281	6,651,855	8,947	3,095,662	28,904	10,521,056
1952	84	7,747	1,582,699	47,077	5,685,236	5,916	1,904,952	25,482	8,460,024
1953	58	4,399	665,189	28,668	2,064,783	3,347	876,914	15,515	3,568,450
1954	26	5,390	916,161	[3] 38,896	2,638,102	4,033	1,105,042	[4] 19,110	4,127,760
1876-1954	-------	813,557	68,237,069	5,333,922	252,099,734	620,740	82,369,069	2,770,158	394,613,322

[1] Based on Kansas ore and old tailings treated at mills during the calendar year indicated.
[2] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of concentrate ("ore") and metal it should be borne in mind that the value given for the concentrate is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.
[3] Includes 360 tons from old tailings remilled.
[4] Includes 194 tons from old tailings remilled.

Zinc.—Mine production of recoverable zinc in Kansas increased 23 percent to 19,110 tons, and the value increased 16 percent to $4.1 million over 1953. The five leading zinc producers were the Eagle-Picher Co., National Lead Co., Mark Twain Mining Co., Mid Continent Lead & Zinc Co., and Wilbur Mining Co. All the zinc output reported in Kansas was mined in Cherokee County. The 1954 zinc-metal price continued the decline started in 1953, opening at 10 cents

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(East St. Louis), dropping to a low of 9¼ cents in February, then gradually rising to 11½ cents in September, where it held for the remainder of the year. The Government purchase program for lead and zinc, which began in June, had a stabilizing effect on base-metal prices. The Eagle-Picher Co. completed constructing its zinc-roasting and sulfuric-acid plant at Galena, Kansas, in August 1954.

One zinc-pigment plant in Montgomery County was operated by the Ozark Smelting & Mining Co.

TABLE 18.—Tenor of lead and zinc ores and concentrates milled, 1953–54

	1953	1954	
	Crude ore	Crude ore	Old tailings
Total material milled ..... short tons	881,254	1,118,197	18,000
Total concentrates produced:			
Galena ..... do	4,399	5,390	----------
Sphalerite ..... do	28,668	38,536	360
Ratio of concentrate to material milled:			
Galena ..... percent	0.49	0.48	----------
Sphalerite ..... do	3.25	3.45	2.00
Metal content of material milled: [1]			
Lead ..... do	0.38	0.36	----------
Zinc ..... do	1.76	1.69	1.09
Average lead content of galena concentrate ..... do	77.63	76.28	----------
Average zinc content of sphalerite concentrate ..... do	60.12	56.23	60.00
Average value per ton:			
Galena concentrate	$151.21	$168.48	----------
Sphalerite concentrate	72.02	68.01	$47.54

[1] Figures represent metal content of the crude ore only insofar as it is recovered in the concentrate; data on tailing losses not available.

TABLE 19.—Mine production of lead and zinc, by months, 1954, in terms of recoverable metals

Month	Lead (short tons)	Zinc (short tons)	Month	Lead (short tons)	Zinc (short tons)
January	240	787	August	434	1,690
February	271	1,012	September	379	2,110
March	196	1,106	October	380	2,234
April	222	980	November	426	2,122
May	305	1,273	December	408	2,180
June	340	1,634			
July	432	1,788	Total	4,033	18,916

TRI-STATE DISTRICT

The Tri-State district of Kansas, Oklahoma, and Southwestern Missouri produced lead and zinc ores totaling 4,092,278 tons of crude ore and 18,000 tons of old tailings, which yielded 24,500 tons of lead concentrate containing 18,300 tons of recoverable lead and 127,000 tons of zinc concentrate containing 64,300 tons of recoverable zinc. Crude-ore tonnage increased 18 percent over 1953, lead concentrate 41 percent, and zinc concentrate 24 percent. Kansas was responsible for 22 percent of the district production of lead concentrate and 31 percent of its zinc concentrate and Oklahoma for 78 percent of the lead concentrate and 66 percent of its zinc concentrate, while Southwestern Missouri's output was 3 percent of the district production of zinc concentrate.

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There were 127 mines operating in 1954, compared with 194 in 1953; 26 were in Kansas, 96 in Oklahoma, and 5 in Southwestern Missouri. There were 9 mine mills operating in January, with 7 continuing into December. The Eagle-Picher Co. (Oklahoma-Kansas) was the largest lead-zinc producer in the district, followed by American Zinc, Lead and Smelting Co. (Oklahoma-Southwest Missouri), National Lead Co. (Kansas), Buffalo Mining Co. (Oklahoma), and John Henderson (Oklahoma-Kansas).

TABLE 20.—Quoted prices of 60-percent zinc concentrate and 80-percent lead concentrate at Joplin, Mo., 1954 [1]

Zinc concentrate		Lead concentrate	
Week ended—	Price per short ton	Week ended—	Price per short ton
Jan. 1–Jan. 11	$56 00	Jan. 1–Jan. 11	$166. 25
Jan. 25–Jan. 31	52. 00	Jan. 19–Jan. 24	159. 05
Feb. 23–Mar. 1	50. 00	Feb. 23–Mar. 1	151. 85
Mar. 12–Mar. 22	54. 00	Mar. 12–Mar. 22	159. 05
Apr. 2–Apr. 12	58. 00	Mar. 30–Apr. 1	166. 25
May 28–June 7	60. 00	Apr. 2–Apr. 12	169. 85
June 8–June 14	64. 00	Apr. 13–Apr. 19	173. 45
Sept. 7–Dec. 31	68. 00	Aug. 31–Sept. 6	177. 05
		Sept. 14–Sept. 20	180. 65
		Sept. 21–Sept. 27	184. 25
		Oct. 5–Dec. 31	187. 85

[1] E&MJ Metal & Mineral Markets.

TABLE 21.—Prices of lead and zinc, 1950–54

Year	Lead per pound	Zinc per pound	Year	Lead per pound	Zinc per pound
1950	$0. 135	$0. 142	1953	$0. 131	$0. 115
1951	. 173	. 182	1954	. 137	. 108
1952	. 161	. 166			

TABLE 22.—Mine production of lead and zinc in the Tri-State district, 1945–49 (average) and 1950–54, in terms of concentrates and recoverable metals

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	34, 367	$6, 245, 059	205, 712	$21, 126, 704	25, 788	$7, 103, 037	110, 223	$26, 897, 001
1950	40, 714	6, 245, 660	150, 019	13, 934, 927	31, 157	8, 412, 390	80, 558	22, 878, 472
1951	36, 300	7, 720, 550	170, 263	21, 023, 818	26, 906	9, 309, 476	91, 553	33, 325, 292
1952	36, 333	7, 388, 754	167, 474	19, 537, 949	27, 356	8, 808, 632	90, 512	30, 049, 984
1953	17, 403	2, 715, 987	102, 821	7, 455, 540	13, 273	3, 477, 526	55, 729	12, 817, 670
1954:								
Kansas	5, 390	916, 161	[1] 38, 896	2, 638, 102	4, 033	1, 105, 042	[2] 19, 110	4, 127, 760
S. W. Missouri	103	16, 826	3. 713	378, 782	77	21, 098	2, 041	440, 856
Oklahoma	19, 004	3, 194, 245	84, 444	5, 466, 727	14, 204	3, 891, 896	43, 171	9, 324, 936
Total 1954	24, 497	4, 127, 232	[1] 127, 053	8, 483, 611	18, 314	5, 018, 036	[2] 64, 322	13, 893, 552

[1] Includes 360 tons from old tailings remilled.
[2] Includes 194 tons from old tailings remilled.

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TABLE 23.—Tenor of ore and concentrates in Tri-State district, 1950–54

	1950	1951	1952	1953	1954
Total material milled:					
Crude ore—short tons	4,700,698	5,990,100	6,140,155	3,454,980	4,092,278
Tailings and slimes—do	967,926	746,673	604,350	----------	18,000
Ratio of concentrate to material milled:					
Lead—percent	0.72	0.54	0.54	0.50	0.60
Zinc—do	2.65	2.53	2.48	2.98	3.09
Metal content of material milled:					
Lead—do	0.55	0.40	0.41	0.38	0.45
Zinc—do	1.42	1.36	1.34	1.61	1.56
Average lead content of galena concentrate—do	78.08	75.62	76.79	77.81	76.28
Average zinc content of sphalerite concentrate—percent	59.66	59.74	60.04	60.22	56.24
Average value per ton:					
Galena concentrate	$153.40	$212.69	$203.36	$156.06	$168.48
Sphalerite concentrate	92.89	123.48	116.66	72.51	66.77

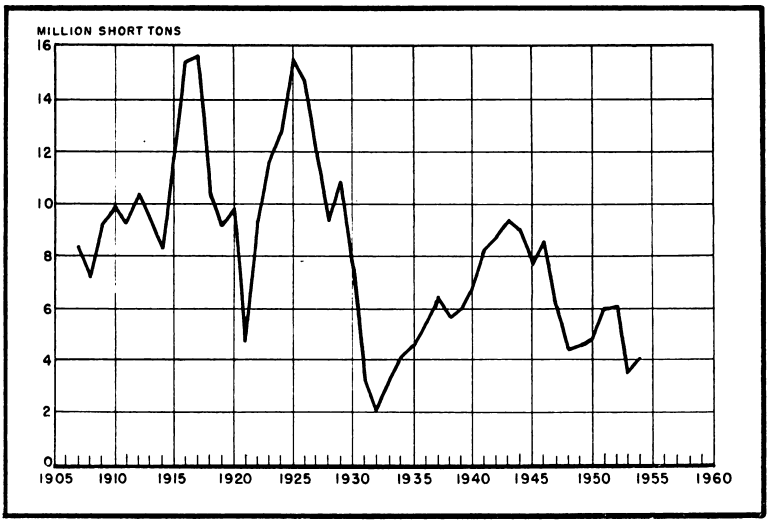

FIGURE 1.—Quantity of crude ore (rock) milled in the Tri-State district, 1907–54.

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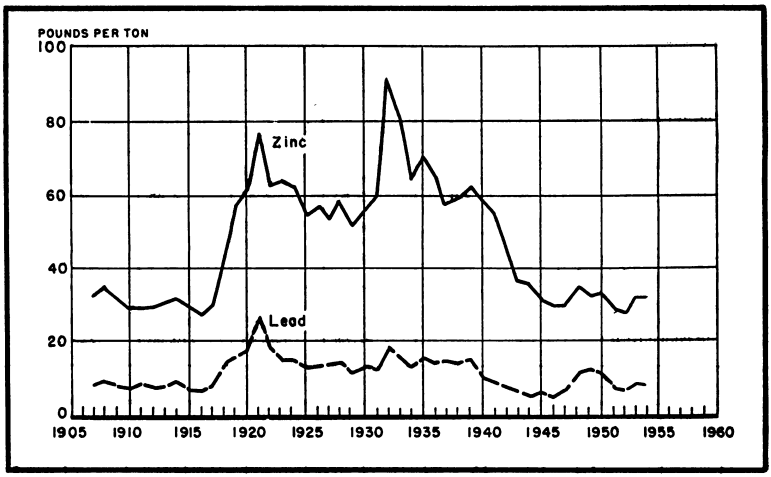

FIGURE 2.—Metal recovered per ton of crude ore (rock) milled in the Tri-State district, 1907–54.

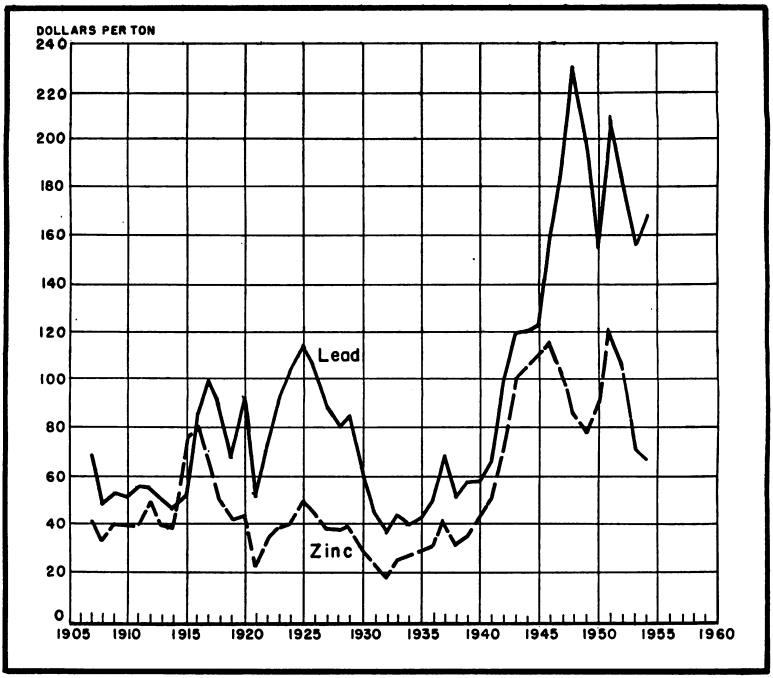

FIGURE 3.—Average prices received by sellers per ton of concentrate in the Tri-State district, 1907–54.

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NONMETALS

Cement.—Cement ranked third in value among the minerals produced in Kansas in 1954. Production totaled 8.8 million barrels, an increase of 36,800 barrels over 1953 production. Shipments of portland cement, totaling 9.1 million barrels valued at $24 million increased 6 percent in quantity and 11 percent in value over 1953. Portland cement was produced by 6 companies operating in 5 counties in eastern Kansas. Several programs of plant improvement and expansion were started in Kansas in 1954. The Consolidated Cement Corp. contracted for equipment to increase the capacity of its plant at Fredonia to 2.3 million barrels annually, an increase of 1.3 million barrels. Included is a new 425-foot kiln and additional grinding equipment. The program was to have been completed about September 1955. Lone Star Cement Corp. remodeled and enlarged its plant at Bonner Springs. Additional equipment included a new kiln and new raw-ball, coal, and clinker-grinding mills. The Monarch Cement Co. completed a new shale-drying-and-crushing plant at a cost of $750,000, which reportedly will cut in half the cost of processing shale. Universal Atlas Cement Co. announced plans to improve its Independence, Kans., plant by installing a new crushing plant and raw-materials storage and modernizing the facilities for drying and blending.[9]

TABLE 24.—Production and shipments of portland cement, 1945–49 (average) and 1950–54, in 376-pound barrels

Year	Production	Shipments	Value of shipments	
			Total	Average per barrel
1945–49 (average)	6,459,140	6,594,586	$12,563,743	$1.91
1950	8,616,357	8,759,103	19,400,068	2.21
1951	8,514,521	8,163,916	19,413,144	2.38
1952	8,672,893	8,811,762	20,956,886	2.38
1953	8,766,206	8,546,250	21,428,536	2.51
1954	8,803,007	9,076,328	23,874,179	2.63

Fort Scott Hydraulic Cement Co. of Fort Scott, Bourbon County, was the only producer of natural cement in 1954. Production, shipments, and value of shipments increased over 1953.

Clays.—The 1954 tonnage and value of all clays produced in Kansas increased over 1953. Eleven companies operating in 8 counties produced clay, excluding that used for cement, compared with 13 companies in 1953. Fire clay was produced in Barton and Cloud Counties and miscellaneous clay in Allen, Cherokee, Crawford, Franklin, Montgomery, and Wilson. Crawford and Franklin Counties were the leading producers of clay in 1954. The Kansas Brick & Tile Co., Inc., began construction of a new plant near Hoisington, Barton County, with a daily capacity of 60,000 brick and an estimated yearly output of 18 million. The Great Bend Brick & Tile Co. planned to make "white" brick at a new plant to be constructed at Kanopolis, Ellsworth County. The daily output was estimated at 40,000 brick. Both brick companies planned to build tunnel kilns, although periodic kilns also will be used.

[9] Pit and Quarry, vol. 47, No. 7, January 1955, pp. 112–115.

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TABLE 25.—Clays sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	487,026	$349,323	1952	665,582	$789,293
1950	706,615	563,670	1953	670,694	749,579
1951	708,910	680,821	1954	(1)	(1)

[1] Figure withheld to avoid disclosure of individual company operations.

Gypsum.—Crude- and calcined-gypsum production in Kansas in 1954 increased slightly in tonnage and value over 1953. Gypsum was produced by National Gypsum Co., of Buffalo, N. Y., near Medicine Lodge, Barber County; and by Certain-teed Products Corp., of Ardmore, Pa., at Blue Rapids, Marshall County.

Diatomaceous Marl.—Diatomaceous marl was produced in Wallace County by the Delore Division of the National Lead Co. of St. Louis, Mo. The crude ore was trucked to the company processing plant at Edson in Sherman County. The material is used as a flatting inert pigment for oil and water-emulsion paints. Production was slightly less in 1954 than in 1953.

Perlite.—Expanded perlite was produced by Panacalite Perlite, Inc., of Kansas City in Wyandotte County, using crude rock from deposits in nearby States. The quantity and value of expanded perlite produced in 1954 increased over 1953. The expanded perlite was used mainly as a lightweight aggregate.

Pumicite or Volcanic Ash.—The 1954 production of pumicite or volcanic ash in Kansas totaled 23,400 tons valued at $93,000, a considerable increase over 1953. Crude pumicite was produced in Lincoln, McPherson, Meade, and Seward Counties; and prepared pumicite was produced in Norton County.

Salt.—Salt ranked fifth in value of all minerals produced in the State in 1954. A total of 876,700 tons valued at $7.8 million was produced, a decrease of 3 percent in quantity and an increase of 4 percent in value over 1953. Rock salt produced was 46 percent greater than that produced by evaporation, but the total value of evaporation-produced salt more than doubled the value of rock salt. Salt was mined in Kansas by five companies operating in Ellsworth, Reno, and Rice Counties; Reno County was the major producer. The total value of salt produced in Kansas has increased 32 percent since 1950. American Salt Corp., at Lyons, Rice County, started expanding and modernizing its plant in September. A new 750-ton press, capable of producing 300 blocks of salt per hour was to be installed, doubling capacity. A new 300-horsepower mine hoist will raise 107 tons of material per hour from a depth of 1,000 feet at a rope speed of 1,200 feet per minute.

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TABLE 26.—Salt sold or used by producers, 1945–49 (average) and 1950–54

Year	Evaporated salt		Rock salt		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	335,566	$3,067,717	512,318	$1,445,453	847,884	$4,513,170
1950	344,751	4,066,310	501,623	1,848,204	846,374	5,914,514
1951	360,785	4,659,036	540,132	1,980,307	900,917	6,639,343
1952	358,887	4,775,741	552,857	2,074,286	911,744	6,850,027
1953	370,569	5,285,805	534,658	2,194,751	905,227	7,480,556
1954	356,045	5,474,151	520,622	2,304,255	876,667	7,778,406

Sand and Gravel.—Sand and gravel, which ranked sixth in value of mineral production in Kansas in 1954, was obtained from 77 counties. Production of sand and gravel increased 19 percent in quantity and 27 percent in value over 1953. Commercial operators produced 8.3 million tons valued at $6.4 million, and Government-and-contractor operations produced 2.1 million tons valued at $829,000. Wyandotte and Sedgwick Counties were the leading producers in 1954, supplying 37 percent of the total value. Sand was used mainly for structural and paving purposes; other sand for railroad ballast, glass, filtering, molding, engines, and miscellaneous purposes. Gravel was used principally for concrete aggregate.

TABLE 27.—Sand and gravel sold or used, 1945–49 (average) and 1950–54

Year	Commercial		Government-and-contractor		Total sand and gravel		
	Short tons	Value	Short tons	Value	Short tons	Value	Average value per ton
1945–49 (average)	3,646,780	$2,196,585	982,660	$320,952	4,629,440	$2,517,537	$0.54
1950	4,987,710	3,246,970	4,793,413	3,535,315	9,781,123	6,782,285	.69
1951	6,167,690	4,234,173	1,509,198	513,371	7,676,888	4,747,544	.62
1952	6,797,975	4,675,216	1,582,090	348,377	8,380,065	5,023,593	.60
1953	6,678,241	4,946,934	2,050,050	721,374	8,728,291	5,668,308	.65
1954	8,340,949	6,365,665	2,080,605	828,506	10,421,554	7,194,171	.69

Stone.—Stone production in 1954 totaled 10.4 million tons valued at $12.9 million. For the first time, limestone used in manufacturing cement was included in the stone total; the production was 2.4 million tons valued at $2.1 million and supplied 16 percent of the value of stone produced in 1954. Greatest activity centered in Wyandotte and Elk Counties, which produced 29 percent of the limestone in the State. Most of the sandstone was obtained from Lincoln, Phillips, and Bourbon Counties; miscellaneous stone was produced in Cherokee County. Over 50 commercial producers and at least 25 noncommercial producers, including county highway departments and Federal agencies, produced stone in 1954; most of it was used for concrete and road metal. Dimension stone was next in importance, having an increase of 67 percent in quantity and 25 percent in value over 1953. Other uses of crushed stone were as agricultural limestone, riprap, and railroad ballast.

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TABLE 28.—Stone sold or used by producers, 1950–54, by kinds

Year	Limestone		Sandstone		Miscellaneous stone		Total stone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1950	5,594,790	$7,673,010	612,220	$793,331	1,423,290	$453,860	7,630,300	$8,920,207
1951	5,824,103	8,284,559	277,446	444,108	1,089,934	329,845	7,191,483	9,058,512
1952	7,551,061	11,204,877	295,246	485,871	984,564	360,992	8,830,871	12,051,740
1953	7,026,871	10,045,111	591,424	809,008	1,150,857	458,831	8,769,152	11,303,950
1954	[1] 9,161,085	[1] 11,956,778	355,436	687,180	860,493	297,864	[1] 10,377,008	[1] 12,941,822

[1] Includes diatomaceous marl and limestone for cement.

Vermiculite (Exfoliated).—Exfoliated vermiculite was produced by Dodson Manufacturing Co. of Wichita, Sedgwick County, using crude vermiculite shipped from other States. The quantity and value of exfoliated vermiculite, used for insulation purposes and as aggregate in concrete and plaster, increased over 1953.

REVIEW BY COUNTIES[10]

Mineral production was reported in 101 of the 105 counties in Kansas in 1954, and 50 counties reported production valued at $1 million or more: Each of 23 counties produced minerals valued between $1 and $5 million, 13 between $5 and $10 million, 7 between $10 and $20 million, 4 between $20 and $30 million, 2 between $30 and $40 million, and 1 over $40 million. Barton County was foremost in mineral production during the year, and Allen County was the major producer of nonfuel commodities. No mineral production was reported in Greeley, Mitchell, Rawlins, and Wichita Counties.

TABLE 29.—Value of mineral production in Kansas, by counties, 1953–54 [1]

County	1953	1954	Minerals produced in 1954 in order of value
Allen	$8,610,766	$9,955,078	Cement, petroleum, stone, clays, natural gas.
Anderson	1,838,728	2,239,436	Petroleum, stone, sand and gravel.
Atchison	(2)	(2)	Stone.
Barber	4,048,303	5,261,159	Petroleum, natural gas, gypsum, natural-gas liquids, sand and gravel.
Barton	45,617,778	46,634,226	Petroleum, natural gas, sand and gravel, clays.
Bourbon	2,497,252	917,703	Stone, natural cement, petroleum, coal.
Brown	----------	9,193	Petroleum, sand and gravel.
Butler	23,240,551	25,143,892	Petroleum, stone, sand and gravel.
Chase	103,053	127,676	Petroleum, sand and gravel, natural gas.
Chautauqua	2,248,293	2,774,924	Petroleum, stone, natural gas, sand and gravel.
Cherokee	7,016,150	7,964,041	Zinc, coal, lead, stone, clays, sand and gravel.
Cheyenne	----------	(2)	Sand and gravel.
Clark	135,623	475,501	Petroleum, natural gas, sand and gravel.
Clay	(2)	224,037	Sand and gravel.
Cloud	284,197	359,006	Sand and gravel, clays.
Coffey	88,969	654,396	Petroleum, stone, sand and gravel, natural gas.
Comanche	(2)	7,875	Sand and gravel, petroleum.
Cowley	9,598,974	13,072,083	Petroleum, stone, sand and gravel, natural-gas liquids, natural gas.

See footnotes at end of table.

[10] Ver Wiebe, W. A., Goebel, E. D., Hornbaker, A. L., and Jewett, J. M., Oil and Gas Developments in Kansas During 1954: State Geol. Survey of Kansas, Bull. 112, September 1955, 199 pp.
Schoewe, Walter H., The Mineral Industry in Kansas, 1950–1954: State Geol. Survey of Kansas, Bull. 119, Part 4, July, 1956, pp. 105–174.
Kansas Business, 1954, 66 pp.
Labor Department, State of Kansas, Report of the Mine Inspection Section and the Mine Rescue Station: Jan. 1, 1952 to June 30, 1954, 120 pp.

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TABLE 29.—Value of mineral production in Kansas, by counties, 1953–54 [1]—Con.

County	1953	1954	Minerals produced in 1954 in order of value
Crawford	$3,511,504	$2,268,356	Coal, petroleum, clays, stone, natural gas.
Decatur	585,804	983,144	Petroleum, sand and gravel.
Dickinson	439,421	483,273	Petroleum, stone, sand and gravel.
Doniphan	341,582	192,371	Stone.
Douglas	162,300	267,201	Stone, sand and gravel, petroleum, natural gas.
Edwards	91,718	243,007	Petroleum, sand and gravel.
Elk	2,098,796	2,340,814	Stone, petroleum, natural gas, sand and gravel.
Ellis	29,552,388	32,060,240	Petroleum, sand and gravel.
Ellsworth	10,080,374	9,722,867	Petroleum, salt, sand and gravel, stone.
Finney	3,208,046	3,847,400	Natural gas, petroleum, natural-gas liquids, sand and gravel.
Ford	150,064	121,346	Sand and gravel, natural gas, petroleum.
Franklin	1,393,296	1,543,174	Petroleum, clays, stone, coal.
Geary	292,145	393,943	Stone, sand and gravel.
Gove	95,731	83,838	Petroleum, sand and gravel.
Graham	9,781,230	10,930,633	Petroleum.
Grant	10,681,261	12,304,390	Natural gas, natural-gas liquids, sand and gravel.
Gray	(2)	(2)	Sand and gravel.
Greenwood	14,964,098	17,376,043	Petroleum, stone, sand and gravel.
Hamilton	459,614	482,577	Natural gas, sand and gravel.
Harper	71,807	462,321	Petroleum, natural gas, sand and gravel.
Harvey	575,693	563,926	Petroleum, sand and gravel, natural gas.
Haskell	3,873,390	2,760,468	Natural gas, sand and gravel, petroleum.
Hodgeman	412,794	394,929	Petroleum.
Jackson	(2)	113,362	Stone, sand and gravel.
Jefferson	485,858	341,558	Stone, natural gas.
Jewell	(2)	2,384	Sand and gravel.
Johnson	632,586	359,838	Stone, petroleum, natural gas.
Kearny	6,910,575	7,375,133	Natural gas, natural-gas liquids, petroleum, sand and gravel.
Kingman	2,072,670	2,751,841	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Kiowa	23,462	29,092	Sand and gravel, petroleum.
Labette	296,481	440,395	Petroleum, stone, natural gas, coal.
Lane	15,554	6,063	Petroleum.
Leavenworth	(2)	552,404	Stone, sand and gravel, natural gas.
Lincoln	559,503	384,329	Stone, pumicite.
Linn	348,588	1,575,336	Coal, petroleum, stone, natural gas.
Logan	(2)	(2)	Sand and gravel.
Lyon	890,122	1,195,863	Petroleum, sand and gravel.
Marion	2,020,532	2,185,469	Petroleum, stone, natural gas.
Marshall	513,623	455,015	Gypsum, sand and gravel, stone.
McPherson	8,932,343	11,421,815	Petroleum, sand and gravel, pumicite, natural gas.
Meade	1,591,528	1,970,458	Petroleum, natural gas, sand and gravel, pumicite.
Miami	1,808,956	2,055,833	Petroleum, stone, natural gas.
Montgomery	6,692,569	8,119,714	Cement, petroleum, clays, stone, natural gas.
Morris	220,644	209,977	Petroleum, stone, sand and gravel, natural gas.
Morton	2,092,370	5,219,125	Natural gas, petroleum, sand and gravel.
Nemaha	994,489	105,952	Petroleum.
Neosho	5,626,677	6,345,735	Cement, petroleum, stone, natural gas.
Ness	778,030	751,438	Petroleum, sand and gravel.
Norton	276,217	2,151,670	Petroleum, pumicite, sand and gravel.
Osage	341,390	327,266	Stone, coal.
Osborne	219,438	265,349	Petroleum, sand and gravel.
Ottawa	(2)	19,650	Sand and gravel.
Pawnee	3,269,638	4,775,803	Petroleum, natural gas, sand and gravel.
Phillips	6,191,448	6,451,110	Petroleum, sand and gravel, stone.
Pottawatomie	85,746	117,698	Stone, sand and gravel.
Pratt	7,420,916	8,339,410	Petroleum, natural gas, sand and gravel.
Reno	9,274,196	10,087,988	Salt, petroleum, natural-gas liquids, sand and gravel, natural gas.
Republic	(2)	(2)	Sand and gravel.
Rice	23,934,107	22,974,468	Petroleum, salt, sand and gravel, stone, natural gas.
Riley	118,500	269,654	Stone, sand and gravel.
Rooks	18,562,323	20,306,549	Petroleum, sand and gravel.
Rush	1,513,297	1,678,824	Petroleum, helium, natural gas, natural-gas liquids,
Russell	33,295,299	31,597,601	Petroleum, sand and gravel, natural gas.
Saline	4,290,859	4,400,249	Petroleum, sand and gravel.
Scott	153,019	182,350	Do.
Sedgwick	5,430,327	5,206,911	Petroleum, sand and gravel, natural-gas liquids, natural gas.
Seward	3,905,102	4,338,534	Natural gas, natural-gas liquids, petroleum, sand and gravel, pumicite.
Shawnee	504,739	709,692	Stone, sand and gravel.
Sheridan	1,021,249	1,133,243	Petroleum, sand and gravel.
Sherman	8,645	12,075	Sand and gravel.
Smith	(2)	(2)	Do.
Stafford	18,328,561	20,305,621	Petroleum, natural gas, sand and gravel.

See footnotes at end of table.

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TABLE 29.—Value of mineral production in Kansas, by counties, 1953–54 [1]—Con.

County	1953	1954	Minerals produced in 1954 in order of value
Stanton	$1,392,074	$1,483,750	Natural gas.
Stevens	8,668,921	10,040,836	Do.
Sumner	4,465,378	5,463,746	Petroleum, sand and gravel, natural gas.
Thomas	41,298	64,057	Sand and gravel, petroleum.
Trego	2,771,081	2,917,495	Petroleum, sand and gravel.
Wabaunsee	1,546,923	599,505	Petroleum, sand and gravel, stone.
Wallace	(2)	(2)	Marl, sand and gravel.
Washington	(2)	(2)	Sand and gravel.
Wilson	2,864,598	3,708,598	Cement, petroleum, stone, clays, natural gas, sand and gravel.
Woodson	1,949,636	2,135,869	Petroleum, natural gas.
Wyandotte	6,633,645	7,112,678	Cement, stone, sand and gravel, natural gas.
Undistributed	3,094,058	793,896	
Total	413,231,000	449,587,000	

[1] Counties not listed because no production reported: Greeley, Mitchell, Rawlins, Wichita.
[2] Value included with "Undistributed."

Allen.—Lehigh Portland Cement Co., at Iola, and The Monarch Cement Co., at Humboldt, produced portland cement in Allen County. The Monarch Cement Co. used limestone for cement and sold limestone for concrete, road metal, and screening purposes. The Allen County Highway Department produced crushed limestone for concrete and road metal. Humboldt Brick & Tile Co., at Humboldt, and United Brick & Tile Co., at Iola, used clay for manufacturing brick and tile. Petroleum production increased 35 percent over 1953; natural gas also was produced.

Anderson.—Garnet Rock Co. quarried and crushed limestone for concrete and road metal. Paving gravel was obtained by the Anderson County Highway Department from local deposits. Oil was produced in Anderson County, the major portion of the production coming from the Bush City Shoestring and Centerville fields.

Atchison.—Limestone was crushed by G. W. Kerford Quarry Co for riprap, road metal, and agricultural purposes and by the United States Army Corps of Engineers for riprap.

Barber.—Output of petroleum increased more than 175,000 barrels during 1954; it was the principal commodity produced in the county. The five major oil fields were Rhodes, Boggs, Whelan, Deerhead, and Skinner. Kansas Power & Light Co. operated its natural-gasoline plant near Medicine Lodge. Natural gas also was produced, ranking second to petroleum. National Gypsum Co., operating in this county, was the major gypsum producer in the State. Paving gravel was produced by the Barber County Highway Department.

Barton.—Barton County ranked first in Kansas in value of mineral production in 1954. The total value of all minerals produced was $46.6 million, 99 percent of which was represented by mineral fuels. Although drilling activity declined 31 percent in 1954, Barton County added 13 new oil pools to the 127 pools active in 1953. Natural gas also was produced. The Great Bend Brick & Tile Co. produced heavy clay products from plastic-fire-clay deposits in the county. Structural and paving sand was produced by Du Bois Sand Co., Moos Bros. Sand Co., Charles Hardesty, Savely Sand Co., Gruver Sand Plant, Arkansas Sand & Gravel Co., and the Barton County Highway Department.

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Bourbon.—Bourbon County produced, in order of importance, stone, natural cement, petroleum, and coal. Limestone was crushed mainly for concrete, road metal, and agricultural purposes by Anderson-Oxandale, Cullor Limestone Co., and Fort Scott Hydraulic Cement Co. The only natural-cement plant in the State was operated by Fort Scott Hydraulic Cement Co. Dimension sandstone was quarried by Bandera Stone Quarry. Petroleum production increased 64 percent during the year. Coal was mined in 1954 by Brooks Coal Co., Garrett Coal Co., Jones Coal Co., and Pellett Coal Co.

Butler.—Butler County ranked fourth both in mineral and petroleum production in Kansas in 1954. Petroleum refineries were operated by El Dorado Refining Co. and Skelly Oil Co., near El Dorado; Socony-Vacuum Oil Co., Inc., near Augusta; and Vickers Petroleum Co., Inc., at Potwin. Limestone was crushed for riprap, concrete, road metal, and agricultural purposes by Concrete Materials Construction Co., Walt Keeler Co., Geo. M. Myers, Inc., George M. Baker, Anderson-Oxandale, and City of El Dorado. Paving gravel was produced by the Butler County engineer.

Chase.—Oil was produced from the Atyeo and Teeter fields in 1954. Natural gas also was produced. The Chase County Highway Department obtained paving gravel from deposits in the county.

Chautauqua.—Petroleum production increased 15 percent during the year, the major fields of the 18 producers being Peru-Sedan, Hale-Inge, Elgin, Landon-Floyd, and Oliver. Drilling activities also increased. Sedan Limestone Co. produced crushed limestone, mainly for concrete and road metal and small quantities for riprap and agricultural purposes. Paving gravel was produced by the Chautauqua County Highway Department. Natural gas also was produced.

Cherokee.—Kansas zinc and lead production originated in Cherokee County. The Eagle-Picher Co. operated its lead smelter and pigment plant, treating zinc and lead ores from Kansas, Oklahoma, Missouri, and Illinois. The company began to operate its new zinc-roasting and sulfuric-acid plant at Galena in August. Cherokee County ranked first in the production of coal in 1954. Coal was mined by seven producers; Pittsburg & Midway Coal Co. was the major producer. Crushed limestone was produced by Francis Reeves Limestone Co. for concrete, road metal, and agricultural purposes. Baxter Chat Co. and Eagle-Picher Co. produced chats, mainly for railroad ballast. Miscellaneous clay was mined by United Brick & Tile Co. and used in manufacturing heavy clay products. The Cherokee County Highway Department produced gravel for paving purposes.

Clark.—Petroleum production increased 400 percent in 1954 in Clark County owing to 17 new oil wells completed in the Harper Ranch field: The Ashland field also yielded petroleum, and both the Ashland and McKinney fields produced natural gas. Paving gravel was produced by the Clark County Highway Department.

Clay.—Sand and gravel for structural and paving purposes was produced by Alsop & Fyfe, John H. Alsop Sand Co., Clay Center Concrete & Sand Co., and the Clay County Highway Department.

Cloud.—Structural and paving sand and gravel and other sands were produced by Ross Sand Co., Inc., Earl Beaver Sand Co., and Hun-

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cousky Sand & Gravel Co. Cloud Ceramics produced plastic fire clay, which was used for manufacturing heavy clay products.

Coffey.—Petroleum production increased over 100 percent in 1954 in Coffey County; most of the production was supplied by Leroy, Virgil North, Dunaway, Finnerty, and Leroy North fields. Crushed limestone was produced by G. W. Baker and Neosho Valley Rock Co., for concrete, road metal, and agricultural purposes. The Coffey County Highway Department produced paving gravel from deposits in the county. Natural gas also was produced.

Comanche.—Paving sand and gravel was produced by the Comanche County Highway Department. The first crude-oil production in the county was 264 barrels from the Robbins Ranch pool, discovered in 1953.

Cowley.—Oil was the most important commodity produced in 1954, increasing 36 percent. Anderson-Prichard Oil Corp. operated its refinery and cracking plant near Arkansas City, and The Texas Co. produced natural gasoline and LP-gases at its plant near Burden. Natural gas was produced in 1954, mainly from the Gibson and New Salem fields. Dimension limestone was quarried by Silverdale Cut Stone Co. and Silverdale Limestone Co. and sold mainly as dressed stone; the remainder was produced for rough-architectural, rubble, curbing, and flagging purposes. Sand and gravel, mainly for structural and paving purposes, was produced by Arkansas City Sand & Gravel Co., Oxford Sand & Gravel Co., Winfield Sand & Gravel Co., Wilson Bros. Gravel Co., Phillips Construction Co., and the Cowley County Highway Department. Small quantities of blast sand and engine sand also were produced.

Crawford.—Crawford County ranked second in coal production. Of the 10 strip mines and 5 underground mines operated in 1954, the major producers were Clemens Coal Co., Victory Coal Co., N Coal Co., True Cherokee Coal Co., and Lucky Star Coal Co. The W. S. Dickey Clay Mfg. Co. produced and used miscellaneous clay in manufacturing heavy clay products. Limestone was crushed by John J. Stark for concrete, road metal, and agricultural purposes. Petroleum and natural gas also were produced.

Decatur.—Petroleum production increased almost 100,000 barrels during 1954. The major fields were Adell Northwest, Jennings, Hardesty, Pollnow West, and Feely. Paving sand was produced by the Decatur County Highway Department.

Dickinson.—Limestone was quarried and crushed by Anderson-Oxandale for concrete and road metal, agricultural, and riprap purposes. Shoffner Sand & Gravel Co. and C. Smith Sand & Gravel Co. produced structural sand, paving sand, and paving gravel from deposits in the county. Crude oil was produced from five fields in Dickinson County.

Doniphan.—Crushed limestone was produced by Everett Quarries, Inc., and Wolf River Limestone, Inc., mainly for concrete, road metal, and agricultural purposes; and by the United States Army Corps of Engineers for riprap.

Douglas.—Clark Rock Quarry and Killough Construction Co. produced crushed limestone, mainly for concrete, road metal, and agricultural purposes; and a small quantity for railroad ballast and riprap.

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Bowersock Mills & Power Co. produced sand and gravel for structural and paving purposes and railroad ballast. Petroleum and natural gas also were produced in Douglas County.

Edwards.—Petroleum production increased about 150 percent over 1953 in Edwards County owing to 20 additional wells completed in the Enlow pool. Bradbridge and Embry fields also yielded petroleum. Dave Showalter produced structural and paving sand.

Elk.—Crushed limestone was the most important commodity produced in Elk County in 1954. Limestone was produced by Concrete Materials Co. and the Elk County Highway Department, chiefly for concrete, road metal, agricultural, and riprap purposes. Petroleum production increased 67 percent and ranked second, followed by natural gas. Paving gravel also was produced by the Elk County Highway Department.

Ellis.—Ellis County ranked second in the State in the production of petroleum, valued at over $32 million. Nine new fields and six new zones in old fields were discovered in 1954. The major producers were Bemis-Shutts, Burnett, Solomon, Burnett Southwest, and Koblitz. Glass sand was produced by Lewis C. Schmidtberger.

Ellsworth.—Crude-oil production declined 10 percent during the year; the major fields were the Stoltenberg, Geneseo-Edwards, and Bloomer. Rock salt was produced by the Independent Salt Co., of Chicago, Ill.; paving sand by Henry Millberger, paving gravel by Johannes Sand Co. and the Ellsworth County Highway Department, and crushed sandstone by the Ellsworth County Highway Department.

Finney.—Finney County ranked fifth in the production of natural gas, and nearly all was from the Hugoton field. Petroleum was produced from eight fields in Finney County, the major producers were the Nunn, Damme, Finnup, Damme Northeast, and Finnup East. Natural gasoline was produced by Northern Natural Gas Co. at its plant near Holcomb. Structural and paving sand, paving gravel, and other gravel were produced by Smith Sand Co., Alsop Sand Co., and the Finney County Highway Department.

Ford.—Dodge City Sand Co., Miller Sand & Gravel Co., and Davis Sand Co. produced structural, paving, and other sands, and paving gravel. Petroleum and natural gas also were produced in Ford County.

Franklin.—The leading product of Franklin County was crude oil; most of the production came from Paola-Rantoul field. Limestone was quarried and crushed by Bert Ross, F. D. Fogle, and the Franklin County Highway Department for concrete, road metal, and agricultural purposes. Miscellaneous clay was obtained from deposits in Franklin County by Buildex, Inc., and used in manufacturing lightweight aggregates. Coal was mined by Red Star Coal Co.

Geary.—Walker Cut Stone Co. produced both crushed and dimension limestone, and crushed limestone was produced on the Fort Riley Reservation. Junction City Sand & Gravel produced structural sand, paving sand, and paving gravel; and More Sand Co. produced glass sand and other sands.

Gove.—Petroleum production declined 21 percent in 1954 and was reported from Coberly, Lundgren South, and Lundgren fields. The Gove County Highway Department produced paving gravel.

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Graham.—Oil valued at almost $11 million (an increase of 15 percent over 1953) was produced in the county. Nine new oil pools were discovered during the year, and the number of new wells was double that in the previous year. Important producing fields included Morel, Cooper, Schmied, Laura, and White Southwest.

Grant.—Grant County ranked second in the production of natural gas, which came from the Hugoton field. Natural gasoline and LP-gases were produced from plants operated near Ulysses by Stanolind Oil & Gas Co., Magnolia Petroleum Co., and Hugoton Production Co. Structural gravel was produced by the Grant County Highway Department.

Greenwood.—Petroleum was the most important commodity produced in Greenwood County and was valued at over $17 million, an increase of 9 percent over 1953. The five major fields were Seeley-Wick, Thrall-Aagard, Madison, DeMalorie-Souder, and Virgil North. The Greenwood County Highway Department produced crushed limestone for riprap and paving gravel.

Hamilton.—Natural gas was produced from the Hugoton field. Four new wells were completed. Syracuse Sand & Gravel Co. produced structural and paving sand and the Hamilton County Highway Department structural gravel.

Harper.—Crude oil was produced in Harper County, the major portion coming from Grabs, Grabs South, Banner, Berg, and Dusenbury fields. Natural gas was produced from Grabs field. Structural and paving sand was produced by the Harper County Highway Department.

Harvey.—Howard R. Thach produced structural sand and paving gravel from deposits in Harvey County. Oil was the primary product of the county, most of the production coming from Hollow-Nikkel, Halstead, Sperling, Graver, and Burrton Northeast fields. Natural gas also was produced.

Haskell.—Natural gas from the Hugoton field was the leading product of Haskell County. During 1954, the first oil well was completed, resulting in the discovery of the Pleasant Prairie pool and production from that pool. Railroad-ballast sand was produced by Atchison, Topeka, & Santa Fe Railroad Co., and structural sand by Howard Mitchell.

Hodgeman.—Petroleum was produced in Hodgeman County in 1954 from Purdyville, Jetmore, and Saw Log Creek fields. Petroleum production declined slightly during the year.

Jackson.—Reno Construction Co. and G. W. Baker produced crushed limestone for concrete and road metal. Paving gravel was produced by the Jackson County Highway Department.

Jefferson.—Roy Baker produced dimension and crushed limestone, and N. R. Hamm and the Jewell County engineer produced crushed limestone. Dimension stone was used as rubble, and crushed limestone for riprap, concrete, road metal, and agricultural purposes. Natural gas also was produced.

Johnson.—Crushed limestone for concrete and road metal was produced by Reno Construction Co., Deitz Hill Development Co., and the Johnson County Highway Department. Dimension limestone for building purposes was quarried by the Johnson County Highway Department. Oil and natural gas also were produced.

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Kearny.—Kearny County's contribution to the mineral wealth of the State came essentially from the production of natural gas. Natural gasoline and LP-gases ranked second in the State in value of production. Colorado Interstate Gas Co., Inc., and Deerfield Petroleum, Inc., operated natural-gasoline plants. Crude oil was produced from the Patterson field. Paving gravel was produced by the Kearny County Highway Department.

Kingman.—Crude oil production increased 37 percent in Kingman County, the 5 major fields being Spivey, Broadway West, Dresden, Willowdale, and Dewey. Natural-gas liquids were produced by Skelly Oil Co. at its plant near Cunningham, and natural gas was produced in Kingman County. Ray Wells produced structural and paving sand.

Labette.—Petroleum production increased 64 percent over 1953, and a small quantity of natural gas also was produced. John J. Stark produced crushed limestone for concrete, road metal, and agricultural purposes. United States Army Corps of Engineers produced crushed limestone for riprap. The Labette County Highway Department produced crushed limestone for concrete and road metal, and dimension limestone for use as rubble. A. E. Gallagher mined coal from a strip pit in the county.

Leavenworth.—Crushed limestone, mainly for concrete, road metal, and railroad ballast, was produced by Loring Quarries, Inc., J. C. Haigood, United States Army Corps of Engineers, Kansas State Penitentiary, and the Leavenworth City Street Department. Missouri Valley Sand Co. produced structural sand. Natural gas also was produced.

Lincoln.—Quartzite Stone Co., Inc., produced crushed sandstone for riprap, concrete, road metal, railroad ballast, and other uses. Pumicite or volcanic ash was produced by Ernest Hanzlicek near Wilson.

Linn.—Linn County ranked third in the production of coal, the primary mineral product of the county in 1954. Coal was mined at 3 strip pits and 1 underground mine. Petroleum production increased 20 percent over 1953, and natural gas also was produced. Murray Limestone Products and Lee Giles produced crushed limestone for concrete, road metal, and agricultural purposes.

Lyon.—Oil production increased 46 percent over 1953. The principal fields producing oil were Atyeo, Bradfield, Bradfield Northwest, and Frankhouser. Wesley Parks produced structural, paving, and other gravel; Henry Waterman railroad-ballast gravel and other sands; and the Lyon County Highway Department paving gravel.

Marion.—Crude oil was produced in Marion County. The major fields included Lost Springs, Wenger, Covert-Sellers, Peabody, and Edmonds. Natural gas also was produced. Riddle Quarries, Inc., produced crushed limestone for concrete, road metal, railroad ballast, and riprap.

Marshall.—Certain-teed Products Corp. produced crude and calcined gypsum from deposits near Blue Rapids. Structural and paving sand and gravel were produced by Blue River Sand & Gravel Co., Hall Brothers, Heinzelman Construction Co., and the Marshall County Highway Department. The Marshall County engineer produced crushed limestone for concrete and road metal.

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McPherson.—San Ore Construction Co. produced pumicite or volcanic ash from deposits near Lindsborg. Crude-oil production increased 20 percent in the county, the major fields being Ritz-Canton, Graber, Lively, Lindsborg, and Welch-Bornholdt. National Cooperative Refinery Assoc. operated its petroleum refinery near McPherson. Paving sand, structural gravel, and paving gravel were produced by A. N. Colburn, San Ore Construction Co., and the McPherson County Highway Department. A small quantity of natural gas was produced.

Meade.—Oil was produced from Novinger, McKinney, Bruno, Adams Ranch East, Bruno Northeast, and Bond fields, and natural gas from McKinney and Adams Ranch fields. San Ore Construction Co. produced structural gravel.

Miami.—The primary product of Miami County was petroleum from Paola-Rantoul, Louisburg, Block, and Beagle fields. L. W. Hayes produced crushed limestone for agricultural purposes and the Miami County Highway Department crushed limestone for concrete and road metal. A small quantity of natural gas was produced.

Montgomery.—Universal Atlas Cement Co. produced portland cement at its plant in Independence. Montgomery County ranked second in the State in cement production. Petroleum was the second most important product, increasing 27 percent over 1953. Cooperative Refinery Assoc. operated a refinery near Coffeyville. Limestone was quarried and crushed by Anderson-Oxandale, Universal Atlas Cement Co., the Montgomery County engineer, and City of Coffeyville Street Department for concrete, road metal, and agricultural purposes. United Brick & Tile Co. and Ludowici-Celadon Co. produced miscellaneous clay for manufacturing brick and tile. Natural gas also was produced. One zinc-pigment plant, the Ozark Smelting & Mining Co., was active in 1954.

Morris.—Petroleum and natural gas were produced in Morris County in 1954. Anderson-Oxandale operated three limestone quarries and produced crushed limestone for concrete, road metal, and agricultural purposes. Paving gravel was produced by Virgil Metcalf and the Morris County Highway Department.

Morton.—The production of natural gas doubled in Morton County in 1954, and the county ranked fourth in the State. Crude oil was produced for the first time. Leo Doolittle produced structural sand and the Morton County Highway Department paving sand.

Neosho.—Neosho County ranked third in the output of cement, which was produced by Ash Grove Lime & Portland Cement Co. at its plant near Chanute. Over 617,000 barrels of oil was produced in the county in 1954. Refineries were operated by Chanute Refining Co. and M. F. A. Oil Co. at Chanute. Harry Byers produced both crushed and dimension limestone and Joe O'Brien and the Neosho County engineer crushed limestone. Dimension stone was used as rubble and crushed stone for concrete, road metal, and agricultural purposes. A small quantity of natural gas also was produced.

Norton.—Norton County production of petroleum increased over 600 percent in 1954 owing to 79 new oil wells completed in the Norton field. Ray, Ray West, and Ray Northwest fields also yielded petroleum. Paving gravel was produced by the Norton County Highway Department, and Wyandotte Chemicals Corp. produced pumicite at Calvert.

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Osage.—Perry Jones and K. B. Dusenbury Limestone Products Co. produced crushed limestone, mainly for concrete and road metal; a small quantity was used for agricultural purposes. Coal was mined from underground mines by A. B. Coal Co., Bell Coal Co., and Central Coal Co.; and from strip mines by Linville & Son Coal, Oxbow Coal Co., and H. A. Rogers & Sons.

Pawnee.—Oil production increased 36 percent in 1954 in Pawnee County. The major fields producing oil were Larned, Pawnee Rock, Garfield, Benson, and Dunes. Natural gas was produced, and most of the production came from Benson and Pawnee Rock fields. Structural, paving, and other sand and gravel were produced by Willis Eakin, Larned Sand & Gravel, and the Pawnee County Highway Department.

Phillips.—The leading product of Phillips County was petroleum. Cooperative Refinery Assoc. operated its petroleum refinery at Phillipsburg. D. G. Hansen produced paving, structural, and railroad-ballast gravel, the Bureau of Reclamation paving sand, and E. C. Schroeder Construction Co. and Texas Construction Co. crushed sandstone for riprap.

Pottawatomie.—Manhattan Stone Co. produced dimension limestone in Pottawatomie County. Crushed and dimension sandstone were produced by the Pottawatomie County Highway Department for building stone and riprap. Wamego Sand Co. produced structural and paving sand, Anderson-Oxandale paving gravel, and the Pottawatomie County Highway Department paving sand and gravel.

Pratt.—Petroleum was the leading product of Pratt County. The major fields producing oil included Iuka-Carmi, Chance, Chitwood, Cunningham, and Frisbie Northeast. Natural gas was produced from Cunningham, Chitwood, and Iuka-Carmi fields. C. D. Hogard produced paving sand, Bob Miller Sand & Gravel Co. structural sand, and the Pratt County Highway Department paving sand and gravel.

Reno.—Reno County ranked first in the production of salt, produced by Barton Salt Co., Carey Salt Co., and Morton Salt Co. at Hutchinson. Petroleum and natural gas were produced. Sand and gravel was produced by six operators in 1954, the major producers being J. E. Steele Sand & Gravel, J. H. Shears' Sons, Inc., and Henderson Sand & Gravel Co. Natural-gas liquids were produced. Cities Service Oil Co. operated its natural-gasoline plant near Burrton.

Rice.—Rice County ranked second in value of the production of salt and fifth in value of the production of petroleum—the most important commodity produced in 1954 in the county. Natural gas was produced from five fields. Evaporated and rock salt was produced by American Salt Corp. Sand and gravel was produced by Rock Hill Sand & Gravel Co., Wright & Birchenough, Inc., Sterling Sand & Gravel Co., A. L. Stapleton, and Arensman Sand & Gravel, mainly for paving purposes. Limestone was quarried and crushed by Riddle Quarries, Inc., for concrete, road metal, and agricultural purposes.

Riley.—Dimension limestone was quarried by Manhattan Stone Co., and crushed limestone by Concrete Materials Construction Co. and Riddle Quarries, Inc., for concrete, road metal, and agricultural

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purposes. Sand and gravel was produced by Walters Sand Co. and the Riley County Highway Department for structural and paving purposes.

Rooks.—Rooks County was one of the leading producers of petroleum in 1954; an increase of 175,000 barrels was reported. The major fields producing oil included Marcotte, Barry, Jelinek, Northampton, and Palco. Paving sand was produced by the Bureau of Reclamation.

Rush.—Helium was produced by the Federal Bureau of Mines at Otis. There was an appreciable production increase in petroleum, natural gas, and natural-gas liquids in 1954. Flynn Oil Co. operated its natural-gasoline plant at Otis.

Russell.—Petroleum production in Russell County ranked third in the State. The five major fields were Hall-Gurney, Trapp, Gorham, Russell, and Fairport. A small quantity of natural gas was produced. The Russell County Highway Department produced paving gravel.

Saline.—The principal product of Saline County was petroleum. Of the 11 fields producing oil, Smolan, Salemsborg, Gypsum Creek, Hunter, and Salina were the most important. Sand and gravel was produced by Saline Sand Co. and Putman Sand & Gravel Co., for structural and paving purposes.

Scott.—Petroleum and sand and gravel were produced in Scott County in 1954. Century Refining Co., Inc., operated its refinery at Shallow Water. San Ore Construction Co. produced structural gravel.

Sedgwick.—Petroleum, natural gas, and natural-gas liquids were the mineral fuels produced in Sedgwick County. Derby Oil Co. operated its petroleum refinery at Wichita. Cities Service Oil Co. operated its natural-gasoline plant at Wichita. Sand and gravel, used principally for structural and paving purposes, was produced in Sedgwick County by 12 operators, including Dolese Bros. Co., Inland Construction Co., Walter Keeler Co., Inc., Miles Sand Service, and Province Sand & Gravel.

Seward.—Natural gas was the leading product of Seward County; natural-gas liquids ranked second. Natural-gasoline plants were operated by Panhandle-Eastern Pipe Line Co. and Northern Natural Gas Co. Structural gravel and pumicite were produced by San Ore Construction Co.

Shawnee.—Dimension limestone, for use as curbing and flagging, was produced by F. E. Fritts. Henry C. Luttjohann and P. H. Netherland produced crushed limestone for concrete, road metal, and agricultural purposes. Structural, paving, engine, and other sands; and structural, paving, and other gravel were produced in Shawnee County by Consumer Sand Co., Kansas Sand Co., Inc., Victory Sand & Stone Co., River Sand Co., Shoffner Sand Co., and the Shawnee County engineer.

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Sheridan.—Petroleum was produced in Sheridan County from Adell, Wessel, Studley, Wessel North, and Hortonville oil fields. San Ore Construction Co. produced structural gravel, and the Sheridan County Highway Department paving sand.

Stafford.—Stafford County ranked seventh in the production of petroleum, the five major fields being Gates, Mueller, Max, Richardson, and Fischer Northwest. Natural gas was produced. Partin Sand & Gravel Co. produced structural sand and other gravel and the Stafford County engineer paving sand.

Stanton.—Natural gas (13,780 million cu. ft.) was the only commodity produced in Stanton County in 1954, all from the Hugoton area.

Stevens.—Stevens County was the principal producer of natural gas with production valued at over $10 million. Gas was produced from Hugoton field.

Sumner.—Petroleum and natural gas were produced in Sumner County. The major fields included Fall Creek, Wellington, Hilltop, Vernon North, and Guelph. Paving, structural, railroad-ballast, and other sands were produced by Mulvane Sand Co., Inc., and paving gravel was produced by the Sumner County Highway Department.

Thomas.—San Ore Construction Co. produced structural gravel, Ed Purma produced structural sand, Joe Hubbard other sands, and the Thomas County Highway Department paving sand. A small quantity of petroleum was produced.

Trego.—Petroleum and sand and gravel were produced in Trego County in 1954. The fields producing oil included Ogallah, Sunny Slope, Groff, Walz, and Diebolt. Ruth O. Wiles produced paving sand and gravel and other sands and the Trego County Highway Department paving gravel.

Wabaunsee.—Petroleum production declined 67 percent from 1953. Production was from Davis Ranch, Newbury, Mill Creek, Woodbury, and Wheat fields. San Ore Construction Co. produced structural gravel, and the Wabaunsee County Highway Department produced paving gravel. Limestone was quarried and crushed by G. W. Baker for concrete and road metal.

Wilson.—The primary product of Wilson County was portland cement, produced by Consolidated Cement Corp., at Fredonia. Carr Rock Products Co. and Benedict Rock Lime Co. produced crushed limestone for concrete, road metal, and agricultural purposes. Petroleum production increased 165 percent over 1953. Natural gas also was produced. Standard Oil Co. of Indiana operated its petroleum refinery at Neodesha. Excelsior Brick Co. and Acme Brick Co. produced miscellaneous clay for manufacturing heavy clay products. A small quantity of paving gravel was produced by the Wilson County Highway Department.

Woodson.—Petroleum and natural gas were produced in Woodson County in 1954. The major fields producing oil included Winterscheid, Quincy, Neosho Falls, Perry, and Buffalo. Natural gas was produced from Vernon field.

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Wyandotte.—Lone Star Cement Corp. produced portland cement at its plant near Bonner Springs. Phillips Petroleum Co. operated its petroleum refinery at Kansas City. Joe Gregor and Mike Gregor produced dimension limestone for rubble. Thompson Strauss Quarries, Inc., Peerless Quarries, Inc., and American Rock Crusher produced crushed limestone for concrete, road metal, and riprap. Nine operators produced structural, paving, and engine sand in 1954; including Stewart Sand & Material Co., Holliday Sand & Gravel Co., Peck Woolf Sand & Material Co., and Kaw Sand Associates. A small quantity of natural gas was produced in the county.

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The Mineral Industry of Kentucky

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Kentucky Geological Survey.

By Avery H. Reed, Jr.,[1] and A. C. McFarlan[2]

THE TOTAL VALUE of Kentucky's mineral production in 1954 declined 14 percent from the previous year; the primary cause was reduced coal production. Although all of the large-tonnage commodities—natural gas, petroleum, sand and gravel, and stone—showed increased production and value compared with 1953, the total gained was only 50 percent of the loss, due to the estimated decline in coal production and value.

As in past years, the mineral fuels—coal, natural gas, natural gasoline, and petroleum—accounted for over 92 percent of the value of Kentucky's mineral production.

The construction materials—clay, cement, sand and gravel, stone, and native asphalt, plus fluorspar—furnished the remainder.

Some of the production data for 1954 were collected jointly with the Bureau of the Census, United States Department of Commerce. Production totals will be compared with Census totals when they are available and differences adjusted or explained. Bureau of Mines data for 1954 in some instances are not directly comparable with those for 1953 because of differences in coverage.

TABLE 1.—Mineral production in Kentucky, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	711,209	$3,118,352	571,481	$2,994,926
Coal	65,060,478	302,871,877	56,964,408	236,736,940
Fluorspar	47,244	2,100,493	35,831	1,510,344
Lead (recoverable content of ores, etc.)	52	13,624	80	21,920
Natural gas (marketed production)—million cu. ft.	71,405	15,638,000	72,713	16,579,000
Natural-gas liquids:				
Natural gasoline—thousand gallons	35,406	2,394,000	28,224	1,552,000
LP-gases—do	176,232	4,993,000	189,966	5,066,000
Petroleum (crude)—thousand 42-gallon barrels	11,518	33,520,000	13,791	40,270,000
Sand and gravel	3,052,155	2,899,932	4,729,606	4,401,793
Stone	[2] 7,429,505	[2] 9,268,237	10,129,725	13,285,786
Zinc (recoverable content of ores, etc.)	489	112,470	458	98,928
Undistributed: Native asphalt, cement, and stone (dimension standstone, 1953). Excludes value of clays used for cement, 1953		4,811,752		5,625,951
Total Kentucky		381,742,000		[3] 327,503,000

[1] Production as measured by mine or plant sales (including consumption by producers).
[2] Excludes limestone used in the manufacture of cement, and dimension sandstone.
[3] The total has been adjusted to eliminate duplication in the value of clays and stone.

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TABLE 2.—Average unit values of minerals produced in Kentucky,[1] 1950–54

Commodity		1950	1951	1952	1953	1954
Clays:						
Ball	short ton	$12.54	$12.69	$12.80	$9.70	$13.10
Fire	do	4.95	6.28	6.56	5.20	6.67
Miscellaneous	do	.95	1.09	1.13	1.27	1.50
Coal	do	5.01	4.89	4.80	4.66	4.16
Fluorspar	do	31.88	34.01	38.57	44.46	42.15
Lead	do	270.00	346.00	322.00	262.00	274.00
Natural gas	thousand cubic feet	.20	.22	.22	.22	.23
Natural-gas liquids:						
Natural gasoline	42-gallon barrel	2.82	3.02	3.00	2.84	2.31
LP-gases	do	1.08	1.12	1.07	1.19	1.12
Petroleum	do	2.76	2.77	2.76	2.91	2.92
Sand and gravel	short ton	.95	.87	.80	.95	.93
Stone	do	1.20	1.22	1.23	1.25	1.31
Zinc	do	284.00	364.00	332.00	230.00	216.00

[1] For greater detail on prices by grades and markets see vol. I, Minerals Yearbook, 1954.

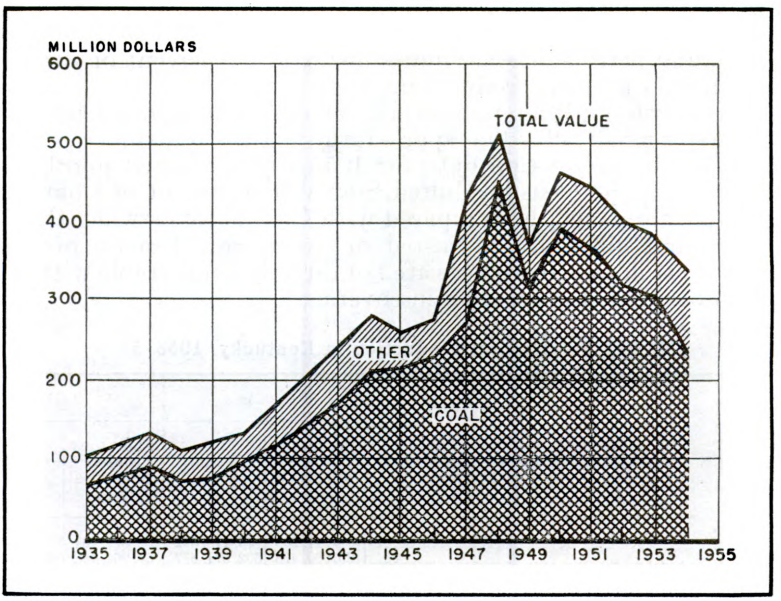

FIGURE 1.—Value of coal and total mineral production in Kentucky, 1935–54.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Asphalt.—Petroleum asphalt was obtained in Kentucky as a by-product in refining petroleum.

The Kentucky Rock Asphalt Co. continued to quarry a natural asphaltic sandstone in Edmondson County near Sweeden and Bee Springs. The sandstone bed is presumed to have been an oil sand in past geologic ages. As the surface was eroded and the pressure decreased, the lighter and more volatile bitumens escaped from the crude oil or were picked up by ground water, leaving only the heavy

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asphaltic bitumens. The sandstone was quarried primarily as road metal for new road construction as well as surface repairing.

Coal.—Kentucky continued in third place among the States in bituminous-coal production. Coal production has declined steadily from the peak year 1947, except for a temporary reversal in 1950. Production in 1954 decreased 12 percent below 1953 and was 32 percent below the peak year 1947.

TABLE 3.—Coal sold or used by producers, 1954, by counties (exclusive of mines producing less than 1,000 tons)

County	Short tons	Value	County	Short tons	Value
Bell	1,222,125	$5,674,940	Letcher	3,864,452	$18,742,996
Boyd	228,450	886,479	McCreary	313,869	1,120,594
Breathitt	791,356	3,888,671	McLean	(1)	(1)
Butler	96,863	375,197	Magoffin	(1)	(1)
Carter	84,702	408,444	Martin	(1)	(1)
Clay	548,813	2,179,965	Menefee	(1)	(1)
Clinton	14,349	51,062	Morgan	18,577	85,450
Daviess	617,634	1,419,541	Muhlenberg	5,106,626	14,646,139
Elliott	(1)	(1)	Ohio	1,701,807	4,882,246
Floyd	4,587,327	25,227,885	Perry	4,017,651	16,305,361
Hancock	1,500	6,000	Pike	5,922,233	27,456,164
Harlan	8,644,487	49,703,074	Pulaski	59,292	227,294
Henderson	246,913	757,405	Rockcastle	60,813	238,400
Hopkins	12,475,148	38,612,752	Union	1,714,726	6,862,138
Jackson	111,198	451,389	Wayne	(1)	(1)
Johnson	309,886	1,177,385	Webster	(1)	(1)
Knott	609,531	2,209,520	Whitley	275,293	1,004,277
Knox	125,721	469,459	Wolfe	9,257	49,793
Laurel	105,067	373,749	Other counties	720,022	2,180,048
Lawrence	16,476	75,778			
Lee	91,069	416,197	Total	56,964,408	236,736,940
Leslie	2,251,175	8,571,148			

[1] Figure withheld to avoid disclosure of individual company operations; included with other counties.

Natural Gas.—Production of natural gas in Kentucky in 1954 reversed the downward trend in recent years; it totaled 72,700 million cubic feet, a 2-percent increase over 1953. The average value of 1,000 cubic feet was 22.8 cents, compared with 21.9 in 1953.

Natural-Gas Liquids.—*Natural Gasoline.*—Production of natural gasoline fell 20 percent below 1953 in quantity and 35 percent below in total value. This reflected a decrease of 19 percent in unit value.

LP-Gases.—Production of LP-gases increased 8 percent over 1953 in quantity but only 1 percent in total value, reflecting a reduction of 6 percent in unit value.

Petroleum.—Production of crude petroleum in Kentucky in 1954 reached an alltime high of 13.8 million barrels, or 20 percent above 1953. The increase may be partly accounted for by an increase of 18 producing wells over 1953, the total for 1954 being 16,618,[3] compared with 16,600 in 1953.

The average value of 1 barrel of crude oil at the well increased from $2.91 in 1953 to $2.92 in 1954.

Activity in the Kentucky petroleum industry was indicated by the completion of 1,188 holes, resulting in 487 oil wells, 214 gas wells, 2 service wells, and 485 dry holes. Only 1 of these holes exceeded 5,000 feet in depth.[4]

[3] Oil and Gas Journal, vol. 53, No. 39, Jan. 31, 1955, p. 147.
[4] Oil and Gas Journal, vol. 53, No. 39, Jan. 31, 1955, pp. 140–143.

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According to the American Petroleum Institute Reserves Committee, the proved crude-petroleum reserves of Kentucky increased 22 million barrels—from 85 million on January 1, 1954, to 107 million on January 1, 1955.

METALS

Lead and zinc.—As in the past, lead and zinc were the only metallic ores mined in 1954. Although lead production increased appreciably, zinc tonnage continued to decline slightly below 1953.

NONMETALS

Cement.—The Kosmos Portland Cement Co. continued to be the only producer in the State and, compared with 1953, reported an increase of 8 percent in quantity and 19 percent in total value.

Clays.—The combined production of all types of clays continued to drop in 1954, with 20 percent less tonnage than in 1953 but only 4 percent less total value, thus reflecting an increase in average value.

Miscellaneous clay displaced fire clay as the top tonnage producer and increased 6 percent in tonnage and 24 percent in total value, an increase of 23 cents a ton in average value.

Fire clay dropped from top-rank production in 1953 to intermediate place in 1954 but maintained its top rank in total value despite its 43-percent reduction in tonnage and 27-percent decrease in total value, compared with 1953. The average unit value increased $1.47 a ton to $6.67.

Ball-clay production decreased 4 percent in tonnage but increased 30 percent in total value, compared with 1953, an increase of $3.40 in average unit value to $13.10.

TABLE 4.—Clays sold or used by producers, 1945–49 (average) and 1950–54

Year	Ball clay		Fire clay		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	94, 311	$1, 007, 833	430, 604	$1, 730, 562	162, 086	$108, 751	687, 021	$2, 867, 146
1950	105, 690	1, 325, 161	422, 898	2, 090, 094	189, 624	180, 710	718, 212	3, 595, 965
1951	111, 215	1, 411, 175	583, 291	3, 660, 626	185, 734	202, 484	880, 240	5, 274, 285
1952	107, 211	1, 372, 695	526, 238	3, 450, 046	247, 425	278, 525	880, 874	5, 101, 266
1953	100, 482	974, 637	348, 359	1, 809, 988	262, 368	333, 727	711, 209	3, 118, 352
1954	96, 483	1, 263, 526	197, 400	1, 316, 364	277, 598	415, 036	571, 481	2, 994, 926

Fluorspar.—Production of fluorspar in Kentucky in 1954 continued the downward trend begun in 1951. The total tonnage marketed in 1954 was 24 percent less and the total value 28 percent less than in 1953. The downward trend in production was emphasized by the reduction of active mines from 49 in 1953 to 39 in 1954. Additional production was reclaimed from four old dumps. The average unit value declined from $44.46 in 1953 to $42.15 in 1954. This was wholly inadequate to permit competition with the imported material from Mexico. Crittenden, Livingston, and Caldwell Counties, in the order named, supplied the fluorspar produced.

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TABLE 5.—Fluorspar shipped from mines, 1945–49 (average) and 1950–54

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1945–49 (average)	79,374	$2,423,499		1952	48,308	$1,863,262	$38.57
1950	80,137	2,554,668	$31.88	1953	47,244	2,100,493	44.46
1951	68,635	2,334,485	34.01	1954	35,831	1,510,344	42.15

Sand and Gravel.—The major production of sand and gravel in Kentucky was from dredges operating in the Ohio River. The State production in 1954 reached an alltime high of 4.7 million tons valued at $4.4 million exceeded that in 1953 by 55 percent in tonnage and 52 percent in total value. A portion of this increase is due to better statistical coverage in 1954. Unit value in 1954 dropped 2 cents a ton below 1953.

Sand production was 2.7 million tons valued at $2.4 million, with an average unit value of 91 cents.

Gravel production was 2.1 million tons valued at $2 million, with an average unit value of 95 cents.

Government-and-contractor production for building and paving purposes consisted of 273,000 tons of sand valued at $63,000, or 23 cents a ton; and 203,000 tons of gravel valued at $75,000, or 37 cents a ton. Commercial material used for building and paving consisted of 2.3 million tons of sand valued at $2.2 million, or 98 cents a ton; and 1.6 million tons of gravel valued at $1.7 million, or $1.05 a ton.

Reports from 21 operators show an estimated total of 894,000 man-hours worked in producing 3.8 million tons of commercial sand and gravel, or 4.2 tons produced per man-hour.

TABLE 6.—Sand and gravel sold or used by producers, 1953–54, by uses

Use	1953		1954	
	Short tons	Value	Short tons	Value
Sand:				
Structural	901,093	$908,173	1,631,347	$1,579,339
Paving	411,416	332,233	891,003	697,881
Engine	67,628	60,030	103,974	107,706
Other	19,680	22,238	26,750	39,481
Total sand	1,399,817	1,322,674	2,653,074	2,424,407
Gravel:				
Structural	746,353	911,756	1,213,335	1,255,568
Paving	551,013	396,397	590,673	505,552
Railroad ballast	328,508	250,580	272,524	216,266
Other	26,464	18,525	[1]	[1]
Total gravel	1,652,338	1,577,258	2,076,532	1,977,386
Total sand and gravel	3,052,155	2,899,932	4,729,606	4,401,793

[1] Included with railroad ballast.

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Stone.—The total stone production in Kentucky in 1954 exceeded that in 1953. Sandstone production increased in both tonnage and value in 1953, and material for foundry use and glassmaking was reported, in addition to dimension stone for building and flagging.

Limestone production increased over 1953 and consisted of both commercial and Government-and-contractor stone. Government-and-contractor stone was reported for use as concrete aggregate and road metal on county roads. The crushed material was marketed for the following uses: Riprap, concrete aggregate, road metal, railroad ballast, agricultural limestone, furnace flux, dust for coal-mine dusting, road-binder dust and chips, stone sand, and other unspecified applications.

TABLE 7.—Stone sold or used by producers, 1953–54, by uses

Use	1953		1954	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone:				
Rough architectural, cubic feet	(1)	(1)	8,434	$12,000
Rubble, short tons	(1)	(1)		
Dressed stone, cubic feet	(1)	(1)	10,506	14,000
Flagging, do			1,205	1,500
Total dimension stone equivalent short tons	(1)	(1)	1,672	27,500
Crushed stone:				
Limestone:				
Riprap, short tons	36,377	$40,254	(1)	(1)
Concrete and road metal, do	6,108,354	7,813,930	7,771,869	10,419,965
Railroad ballast, do	607,073	560,678	421,471	419,840
Agricultural, do	677,701	853,375	1,113,663	1,391,024
Miscellaneous, do			(1)	(1)
Sandstone:				
Foundry, do			(1)	(1)
Glass, do			(1)	(1)
Total stone	[2] 7,429,505	[2] 9,268,237	10,129,725	13,285,786

[1] Bureau of Mines not at liberty to publish.
[2] Incomplete to avoid disclosure of individual company data.

REVIEW BY COUNTIES

Of the 120 counties in the State, 85 reported mineral production in 1953, and 21 of the 85 reported coal only; 34 counties had no mineral production.

In 1954, 86 counties reported mineral production; of these, 18 were counties that reported coal only; 34 counties had no mineral production. Bourbon County, with no production in 1953, reported limestone in 1954; Campbell and Russell Counties, credited with production in 1953, reported none in 1954.

Adair.—Shamrock Stone, Inc. (Butler quarry), was the only mineral producer in the county. The company quarried and crushed 91,000 tons of limestone for concrete and road metal and marketed 12,500 tons for agricultural purposes. The total value was $144,000, or 18 percent below 1953.

Anderson.—Kentucky Stone Co., Inc. (Tyrone quarry), continued to produce crushed limestone for concrete aggregate, road metal, railroad ballast, and agricultural use. Total production and value were 5 percent below 1953.

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TABLE 8.—Value of mineral production in Kentucky, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954, in order of value [2]
Adair	(3)	$144, 250	Limestone.
Anderson	(3)	(3)	Do.
Barren	(3)	(3)	Do.
Bell	$8, 397, 724	5, 782, 468	Coal, limestone, sand and gravel.
Boone	(3)	3, 068	Sand and gravel.
Bourbon	(3)	58, 634	Limestone.
Boyd	(3)	964, 479	Coal, miscellaneous clay.
Boyle	(3)	220, 251	Limestone, sand and gravel.
Breathitt	5, 341, 387	3, 888, 671	Coal.
Breckenridge	224, 712	(3)	Limestone, miscellaneous clay.
Butler	363, 633	375, 197	Coal.
Caldwell	479, 629	(3)	Limestone, fluorspar.
Carroll	(3)	(3)	Sand and gravel.
Carter	2, 250, 182	1, 748, 404	Fire clay, coal, limestone.
Casey	(3)	(3)	Limestone.
Christian	147, 116	835, 922	Limestone, coal, miscellaneous clay.
Clark	(3)	126, 082	Limestone.
Clay	3, 627, 684	2, 179, 965	Coal.
Clinton	(3)	89, 062	Coal, limestone.
Crittendon	1, 954, 184	1, 872, 475	Fluorspar, limestone, zinc, sandstone, lead.
Cumberland	(3)	(3)	Limestone.
Daviess	1, 974, 027	1, 745, 129	Coal, sand and gravel, miscellaneous clay.
Edmonson	(3)	(3)	Limestone, asphalt.
Elliott	74, 831	(3)	Coal.
Fayette	499, 567	(3)	Limestone.
Fleming	(3)	295, 168	Do.
Floyd	32, 681, 277	25, 248, 573	Coal, sand and gravel.
Franklin	(3)	323, 474	Limestone.
Fulton	(3)	(3)	Sand and gravel.
Gallatin	(3)	(3)	Do.
Graves	1, 050, 989	1, 362, 654	Ball clay, fire clay.
Grayson	(3)	119, 370	Limestone.
Greenup	272, 087	(3)	Sand and gravel.
Hancock	(3)	40, 600	Miscellaneous clay.
Hardin	199, 304	452, 940	Limestone, miscellaneous clay.
Harlan	59, 026, 512	49, 703, 074	Coal.
Harrison	(3)	(3)	Limestone.
Hart	(3)	(3)	Do.
Henderson	(3)	870, 181	Sand and gravel, coal.
Hopkins	(3)	38, 613, 679	Coal, miscellaneous clay.
Jackson	716, 177	531, 389	Coal, limestone.
Jefferson	7, 216, 060	4, 590, 880	Cement, limestone, sand and gravel, miscellaneous clay.
Jessamine	(3)	(3)	Limestone.
Johnson	2, 128, 540	1, 177, 385	Coal.
Kenton	(3)	(3)	Limestone.
Knott	3, 626, 726	2, 209, 520	Coal.
Knox	(3)	477, 999	Coal, miscellaneous clay.
Laurel	1, 049, 647	373, 749	Coal.
Lawrence	(3)	101, 778	Coal, sand and gravel.
Lee	(3)	673, 457	Coal, limestone.
Leslie	10, 034, 730	8, 571, 148	Coal.
Letcher	(3)	18, 882, 251	Coal, limestone.
Livingston	574, 121	(3)	Limestone, fluorspar.
Logan	324, 687	237, 075	Limestone, sandstone.
Madison	(3)	113, 869	Limestone, miscellaneous clay.
Magoffin	1, 063, 570	(3)	Coal.
Marion	229, 120	(3)	Limestone, sand and gravel.
Martin	75, 542	(3)	Coal.
Mason	(3)	(3)	Sand and gravel, miscellaneous clay.
McCracken	(3)	(3)	Sand and gravel.
McCreary	970, 912	1, 120, 594	Coal.
McLean	30, 159	----------	----------
Meade	(3)	(3)	Limestone.
Menifee	(3)	117, 988	Do.
Mercer	(3)	(3)	Do.
Metcalfe	(3)	74, 568	Do.
Monroe	(3)	(3)	Do.
Morgan	(3)	172, 700	Coal, limestone.
Muhlenberg	15, 359, 591	14, 861, 532	Do.
Ohio	(3)	5, 360, 252	Do.
Owsley	43, 109	----------	----------
Perry	24, 736, 518	16, 305, 361	Coal.
Pike	40, 845, 155	27, 456, 164	Do.
Powell	(3)	161, 281	Limestone, miscellaneous clay.
Pulaski	(3)	561, 358	Coal, limestone.
Rockcastle	(3)	754, 304	Do.
Rowan	91, 104	(3)	Limestone, miscellaneous clay.

See footnotes at end of table.

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TABLE 8.—Value of mineral production in Kentucky, 1953–54, by counties [1]—Continued

County	1953	1954	Minerals produced in 1954, in order of value [2]
Russell	(3)		
Simpson	(3)	$120,934	Limestone.
Todd	(3)	109,313	Do.
Trigg	(3)	(3)	Do.
Union	$4,038,362	6,910,618	Coal, sand and gravel, miscellaneous clay.
Warren	(3)	(3)	Limestone.
Wayne	(3)	91,727	Coal, limestone.
Webster	1,475,219	(3)	Coal.
Whitley	(3)	1,017,277	Clay, coal.
Wolfe	64,477	49,793	Coal.
Undistributed	148,483,629	77,131,578	
Total	381,742,000	327,503,000	

[1] The following counties are not listed because no production was reported: Allen, Ballard, Bath, Bracken, Bullitt, Calloway, Campbell, Carlisle, Estell, Garrard, Grant, Green, Henry, Hickman, Larue, Lewis, Lincoln, Lyon, Marshall, Montgomery, Nelson, Nicholas, Oldham, Owen, Pendleton, Robertson, Russell, Scott, Shelby, Spencer, Taylor, Trimble, Washington, and Woodford.
[2] Values of petroleum and natural gas are not shown by county, but State total is included with "Undistributed."
[3] Value included with "Undistributed."

Barren.—J. F. Pace Construction Co. (Pace quarry) more than doubled the production of crushed limestone, compared with 1953. The average unit value was lower than in 1953.

Bell.—Kentucky-Virginia Stone Co. (Pineville quarry) reported the initial production of 51,000 tons of crushed limestone valued at $99,000, primarily for concrete aggregate and road metal, and an additional small tonnage of riprap. Coal production was 1.2 million tons, compared with 1.7 million in 1953. Levi Polly reported initial shipments from a sandstone quarry near Pineville; all output was converted into sand for building purposes.

Boone.—Boone County Highway Department reported the production and use of 500 tons of paving sand and 5,000 tons of paving gravel.

Bourbon.—Bourbon Limestone Co., Inc., reported an initial production of 40,000 tons of crushed limestone valued at $59,000 from its Snap quarry. The major portion was marketed for concrete aggregate and road metal and some for agricultural purposes.

Boyd.—Big Run Coal & Clay Co. reported the production of 33,000 tons of clay from underground mining operations for its own use, valued at $78,000. Coal production was 228,000 tons, compared with 332,000 in 1953.

Boyle.—Caldwell Stone Co. (Danville quarry) increased the production of crushed limestone (for concrete aggregate, road metal, and agricultural purposes) 16 percent above 1953; the total value was up 15 percent. The Boyle County Highway Department reported production of 10,000 tons of crushed limestone (for concrete aggregate and road metal), valued at $16,000. The same department reported the production of 3,000 tons of paving gravel.

Breathitt.—Coal production was 791,000 tons, compared with 1 million in 1953.

Breckenridge.—Murray Tile Co., Inc., continued to produce clay for its own use in manufacturing high-grade tile and increased production 125 percent in tonnage and 110 percent in total value. Hardinsburg Stone Co. (Hardinsburg quarry) and Kentucky Stone

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Co. (Webster quarry) continued to produce crushed limestone for concrete aggregate, road metal, and agricultural purposes; Kentucky Stone Co. also quarried material for roalroad ballast. The total production for the county was 3 percent below 1953 in tonnage and 5 percent below in total value.

Butler.—Coal production was 119,000 tons, compared with 95,200 in 1953.

Caldwell.—There were only 2 active fluorspar mines in 1954, compared with 4 in 1953. The Williamson mine, leased in 1953 by Earnest French, continued under the same lease part of 1954 and the remainder of the year under lease to P. L. Perkins. The other active mine, the Beavers, operated by J. Willis Crider Fluorspar Co., reported the greater tonnage in 1954. In addition to production from active mines, P. L. Perkins and Gill Williamson also marketed a small quantity from old mine dumps. The total county production exceeded that in 1953 in both tonnage and value by a considerable margin. Cedar Bluff Stone Co., Inc. (Cerulean quarry), and Fredonia Valley Quarries, Inc. (Fredonia quarry), continued to produce crushed limestone for agricultural purposes; the former also marketed material for concrete aggregate and road metal and the latter for riprap and other unspecified uses. The county total of crushed limestone was 20 percent below 1953 in tonnage and 17 percent below in total value, an average increase of 5 cents in unit value.

Carroll.—Carrollton Gravel-Sand Co., Inc. (Carrollton pit), continued to produce structural sand and gravel and railroad ballast and paving gravel. Standard Materials Co. reported initial production from the Milton pit of structural and paving sand and gravel.

Carter.—Carter County again, supplied the major portion (95 percent) of Kentucky's production of fire clay. The principal producers were General Refractories Co. (Olive Hill mine), North American Refractories Co. (Bailey, Hayward, and Lowe mines), and Harbison-Walker Refractories Co. (Brinegar, Riggs, and Stenson mines), who together furnished 86 percent of the county fire-clay production. Coal production was 85,000 tons, compared with 129,000 in 1953. Standard Slag & Stone Co. (Carter quarry) increased slightly both tonnage and value of crushed limestone for concrete aggregate and road metal.

Casey.—Casey Stone Co. (Bethel Ridge quarry) continued to mine and crush limestone for concrete aggregate, road metal, and agricultural purposes and also marketed some riprap. Total production was less than in 1953, and reported values indicated a material decline in value.

Christian.—Dalton Bros. Brick Co. (Hopkinsville mine) continued mining clay for its own use in manufacturing heavy clay products; production was appreciably less than in 1953. Hopkinsville Stone Co., Inc., and Christian Quarries, Inc., both with quarries in Hopkinsville; and Lambert Bros. Inc. (Fort Campbell quarry), all quarried limestone for concrete aggregate and road metal. The former two firms also marketed agricultural limestone, and Hopkinsville Stone Co., Inc., sold limestone for other unspecified uses. The total crushed-limestone production in the county was appreciably greater in tonnage and value than in 1953.

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Clark.—Allen Co., Inc., reported the initial production of 111,000 tons of crushed limestone from the Boonesboro quarry valued at $126,000. This constituted the entire mineral production of the county.

Clay.—Coal production was 549,000 tons, compared with 794,000 in 1953.

Clinton.—Shamrock Stone, Inc., reported a production of 25,000 tons of crushed limestone, valued at $38,000, from the Caldwell quarry, for use as concrete aggregate, road metal, and agricultural purposes. Coal production was 14,000 tons, compared with 19,200 in 1953.

Crittenden.—Lead and zinc concentrates were recovered as by-products from fluorspar ores. Crude-fluorspar production was reported from 36 mines and 2 mine dumps, compared with 41 mines in 1953. The mines recording the largest production in 1954 were the Commodore, of Ozark-Mahoning Co.; the Tabb No. 1 and Yandell No. 22, of United States Steel Corp.; and the Pigmy mine, of Rosiclare Lead & Fluorspar Mining Co., which again produced after having no production in 1953. The crude-fluorspar production reported for 1954 in Crittenden County was less than half that of 1953. Alexander Stone Co. operated its No. 1 quarry for crushed limestone. Production was 172,000 tons valued at $221,000, a reduction of 21 percent in tonnage and 20 percent in value from 1953, reflecting a slight rise in unit value. Marion Silica Co., Inc., reported initial crushed-sandstone production from its Marion quarry; the material produced was marketed for foundry and glass-manufacturing use.

Cumberland.—The only mineral production reported for Cumberland County was crushed limestone for concrete aggregate, road metal, and agricultural purposes from the Wells quarry of Cumberland Construction Co. The output was 33 percent below 1953 in tonnage but 29 percent below in total value, reflecting an average increase in unit value of 10 cents a ton.

Daviess.—Joseph L. Clark Tile Co. (Moselyville mine) mined a small quantity of clay for its own use in manufacturing heavy clay products. Owensboro River Sand & Gravel Co. continued to recover sand and gravel from riverbed deposits by hydraulic dredge for structural and paving sand and gravel and engine sand. The output was somewhat below that in 1953 in both quantity and total value. Coal production was 618,000 tons, compared with 612,000 in 1953.

Edmonson.—Bituminous sandstone was quarried from a natural geologic formation containing from 5 to 8 or more percent of heavy, nonvolatile bitumens; after reduction by crushing or grinding, it was marketed as a natural asphaltic road metal or road base or as surfacing material or surface-pavement patching. Kentucky Rock Asphalt Co. quarried this material (a high-quality silica sand impregnated with asphalt, statistically classified under asphalt as bituminous sandstone) near Sweeden and Bee Springs and distributed it by truck. McLellan Stone Co. reported initial production of limestone from its Horse Cave quarry for concrete aggregate, road metal, and agricultural use.

Elliott.—Coal production was continued in Elliott County.

Fayette.—Central Rock Co. and Blue Grass Stone Co., both with quarries near Lexington, continued to produce crushed limestone for

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concrete aggregate and road metal; the latter company also marketed some agricultural limestone. The combined total production was 5 percent above 1953 in tonnage and 14 percent in total value, indicating an average increase in unit value of 9 cents a ton.

Fleming.—Gorman Construction Co. reported the only mineral production for Fleming County from its Carpenter quarry. Total production was 212,000 tons of crushed limestone valued at $295,000, for riprap, concrete aggregate, road metal, and agricultural use.

Floyd.—W. R. Walters Pike Sand Co. reported initial production of building and engine sand. Coal production was 4.6 million tons, compared with 5.6 million in 1953.

Franklin.—Blanton Stone Co., Inc. (Frankfort quarry), and Frankfort Builders Supply, Inc. (Devils Hollow quarry), continued to produce crushed limestone for concrete aggregate, road metal, and agricultural use. The former company also marketed some railroad ballast and the latter some stone sand. The combined production was 15 percent less than in 1953 in tonnage and 14 percent less in total value, indicating a slight rise in unit value.

Fulton.—Hickman Sand & Gravel Co. reported substantial initial production of structural and paving sand and gravel.

Gallatin.—Gallatin Sand & Gravel Co. increased its production of sand and gravel over fivefold, compared with 1953; the output had more diversified markets than in the previous year.

Graves.—Graves County is an important clay-producing county; it produces all of the State ball clay and a substantial portion of its fire clay. Ball clay was mined and marketed by Old Hickory Clay Co. (Graves County mine), Kentucky-Tennessee Clay Co. (Tennessee mine), Cooley Clay Co., Inc. (Greenfield mine), and Kentucky Clay Mining Co. (Warren mine). The total production was 4 percent below 1953, but the total value was 30 percent greater, reflecting a 35-percent increase in average value a ton. In addition to ball clay Kentucky-Tennessee Clay Co. and Kentucky Clay Mining Co. also produced a substantial quantity of fire clay. Total tonnage was less than in 1953 but total value was up substantially.

Grayson.—Rogers & Brunnhoeffer (Grayson County quarry) and Ragland Bros. (Leitchfield quarry) continued to produce crushed limestone for concrete aggregate, road metal, and agricultural purposes; production was 87,000 tons valued at $119,000.

Greenup.—Worthington Sand & Gravel Co. reported initial recovery of washed paving sand and gravel from the Worthington pit.

Hancock.—Owensboro Sewer Pipe Co. is reported to have mined 23,000 tons of clay, valued at $41,000, from the Lewisport mine for use in manufacturing heavy clay products. Compared with 1953, tonnage was up 21 percent and total value 32 percent. Coal production was 1,500 tons, compared with 125,000 in 1953.

Hardin.—West Point Brick Co. continued to operate its West Point clay mine to supply its brick plant with raw material for manufacturing heavy clay products. Production and total value were substantially below that in 1953. Kentucky Stone Co. (Lilmay and Upton quarries), Waters Construction Co. (Elizabethtown quarry), and Osborne Bros. (Hardin County quarry) reported the production of crushed limestone for concrete aggregate and road metal; and Kentucky Stone Co. also marketed some limestone for agricultural use.

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The total production of crushed limestone was 346,000 tons valued at $436,000, a substantial increase in both tonnage and value over 1953.

Harlan.—Coal production was 8.6 million tons compared with 10 million in 1953. Harlan County led all other Kentucky counties except Hopkins in coal production.

Harrison.—Genet Stone Co. quarried a substantially increased tonnage, compared with 1953, of crushed limestone for concrete aggregate, road metal, and agricultural use from its Cynthiana quarry. The total value was up proportionately.

Hart.—McLellan Stone Co. nearly doubled its tonnage of crushed limestone, compared with 1953, from its Horse Cave quarry. All output went into the concrete-aggregate and road-metal market.

Henderson.—Production of river-bed sand and gravel by Bedford-Nugent Co., Inc., by dredging decreased sharply from that of 1953. Coal production was 247,000 tons, compared with 265,000 in 1953.

Hopkins.—Clark's Clay Products Co. (Ashbyburg mine) mined a small tonnage of clay for its own use in manufacturing heavy clay products. Coal production was 12.5 million tons, compared with 12.5 million in 1953, and exceeded that of any other Kentucky county.

Jackson.—Roy Clark (Big Hill quarry) reported an initial production of 44,000 tons of crushed limestone, valued at $80,000, for concrete aggregate, road metal, and agricultural use. Coal production was 111,000 tons, compared with 150,000 in 1953.

Jefferson.—The Kosmos Portland Cement Co., Inc., continued to operate its plant at Kosmosdale. Production and total value were substantially above 1953, and average value also increased. Louisville Pottery Co. continued to mine a small tonnage of clay for manufacturing flowerpots and art pottery, and Southern Brick & Tile Co. mined and used clay for heavy clay products; both companies operated at approximately the same rate as in 1953. There were 6 active crushed-limestone producers, compared with 5 in 1953. Falls City Stone Co. (Buechell quarry), Louisville Crushed Stone Co. (Jefferson County quarry), W. T. Liter (Liter's quarry), Jefferson County Stone Co. (Avoca quarry), and Okolona Stone quarry were joined in 1954 by the Louisville & Nashville Railroad Co. (Avoca quarry). The total output for the county was 1.8 million tons valued at $2.7 million which is an increase of 37 percent in tonnage and 53 percent in total value, compared with 1953, and indicates an average increase of 16 cents a ton. The Louisville & Nashville Railroad Co. quarried limestone for railroad ballast and other unidentified uses. Louisville Crushed Stone Co. and the Okolona Stone quarry confined production to concrete aggregate and road metal, whereas Jefferson County Stone Co., and W. T. Liter marketed agricultural limestone, in addition to concrete aggregate and road metal. Sand and gravel credited to Jefferson County is recovered from river beds and may actually come from areas bordering other counties; because it is impossible to determine the exact quantities taken from each county by the moving dredges, such production is assigned to Jefferson County, the home county of the business offices of the producers. There were six active producers—R. W. Green Sand & Gravel Co., Humpich Sand Co., Ohio River Sand Co., E. T. Slider, Inc., Nugent Sand Co., and H. B. Hammond Co. Production of sand and gravel was 1.8 million tons valued at $1.9 million, or 22 percent greater than 1953 in tonnage and

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40 percent greater in total value; this indicates an increase of 13 cents a ton in average value.

Jessamine.—Kentucky Stone Co. continued operation of its High Bridge crushed-limestone quarry for concrete aggregate, road metal, railroad ballast, and agricultural limestone; production was somewhat lower in tonnage and total value than in 1953, but the average value was slightly higher.

Johnson.—Coal production was 310,000 tons, compared with 461,000 in 1953.

Kenton.—Production of crushed limestone for concrete aggregate and road metal from the Covington quarry of Franxman Brothers was 20 percent lower in both tonnage and total value than in 1953.

Knott.—Coal production was 610,000 tons, compared with 838,000 tons in 1953.

Knox.—Barbour Brick & Tile Co. continued to produce clay for its own use in manufacturing heavy clay products. The output was substantially below that of 1953. Coal production was 126,000 tons, compared with 178,000 in 1953.

Laurel.—Coal production was 105,000 tons, compared with 230,000 in 1953.

Lawrence.—Elkhorn Sand Co., Inc. (Louisa mine), mined and prepared engine sand at little change in rate or value from 1953. Coal production was 16,000 tons, compared with 55,500 in 1953.

Lee.—Kentucky Stone Co. continued to quarry crushed limestone for concrete aggregate, road metal, railroad ballast, and agricultural limestone from its Yellow Rock quarry; the output was appreciably less than in 1953, but the average value was up slightly. Coal production was 91,000 tons, compared with 179,000 in 1953.

Leslie.—Coal production was 2.3 million tons, compared with 2.4 million in 1953.

Letcher.—Levisa Stone Corp. continued to quarry and crush limestone for concrete aggregate and road metal from its Jenkins quarry, but production was somewhat below that of 1953. Coal production was 3.9 million tons, compared with 5 million in 1953.

Livingston.—The principal producers of crude fluorspar were Roberts & Frazer and Tinsley & Loyd; additional crude ore came from Wayne Brown and D. P. Stubblefield; the total county production of crude ore was nearly 10 percent greater than in 1953. Garrett's quarry, operated in 1953 by Ward & Montgomery, was taken over in 1954 by West Tennessee Limestone Co., which with Reed Crushed Stone Co., Inc. (Grand Rivers quarry), reported a total county production of crushed limestone for concrete aggregate, road metal, agricultural use, and riprap many times that of 1953.

Logan.—Kentucky Stone Co. continued to operate its Russellville quarry for crushed limestone for concrete aggregate, road metal, railroad ballast, and agricultural use; the output was appreciably less than in 1953, but the average unit value was slightly higher. There were two active producers of dimension sandstone—Kentucky Flagstone Co. (Lewisburg quarry) for rough architectural material and flagging and Kolor Stone Quarries (Russellville quarry) for dressed building stone; the combined county production was less in quantity but greatly enhanced in total value owing to marketing a greater percentage of the higher value, dressed, building stone and flagging.

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Madison.—Etta Grinstead (Waco mine) reported mining a small amount of clay for manufacturing high-grade tile. Kentucky Stone Co. greatly increased the production of crushed limestone from its Boonesboro quarry, for concrete aggregate, roadstone, and agricultural uses.

Magoffin.—The production of coal was continued in Magoffin County.

Marion.—Ward & Montgomery and Lebanon Stone Co. continued operations near Lebanon, but the combined production of stone was reduced from 1953 both in tonnage and value. The Marion County Highway Department reported production and use of 50,000 tons of building sand.

Martin.—Coal production was continued in Martin County.

Mason.—Sphar Brick Co. continued to mine clay for its own use in manufacturing heavy clay products. J. F. Hardyman Co. reported initial production of building, paving, and filter sand; and building, paving, and railroad-ballast gravel.

McCracken.—Sand and gravel was the only mineral commodity produced in McCracken County in 1954. Government-and-contractor paving-gravel production in the amount of 50,000 tons, valued at $108,000, was reported by the McCracken County Highway Department. There were 4 active producers of commercial sand and/or gravel, compared with 2 in 1953; Federal Materials Co., Inc., mined and sold paving and engine sand and paving and railroad-ballast gravel; Massac Materials Co. confined production to building gravel and gravel for railroad ballast; Smiley Sand & Gravel Co. reported a substantial production of paving sand and Keeling Bros. gravel pit a small tonnage of paving gravel; the total county production of sand and gravel was 14 percent less than in 1953 and the total value 25 percent less, indicating a reduction in average value.

McCreary.—Coal production was 314,000 tons, compared with 211,000 in 1953.

McLean.—The production of coal was continued in McLean County.

Meade.—Kentucky Stone Co. continued to operate its Gaston quarry for crushed limestone for part of 1954 but abandoned the quarry before the end of the year; production was substantial but somewhat below 1953. Kosmos Portland Cement Co. continued to operate its quarry and somewhat increased production of limestone for cement, compared with 1953.

Menifee.—A. W. Walker & Son continued to produce crushed limestone for concrete aggregate, road metal, and agricultural use from its Frenchburg quarry; the total output was above that of 1953. Coal production was continued.

Mercer.—Mercer Stone Co. (Harrodsburg quarry) reported initial production of limestone for concrete aggregate and road metal.

Metcalfe.—Montgomery & Co. continued to operate its Chapman & Word quarries for crushed limestone for concrete aggregate, road metal, and agricultural use; the total production was 52,000 tons valued at $75,000, slightly less than in 1953.

Monroe.—Monroe-Cumberland Stone Co. continued to produce crushed limestone for concrete aggregate, road metal, and agricultural

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use from its Tomkinsville quarry but at a considerably curtailed rate compared to that of 1953.

Morgan.—The Zag quarry of Licking River Limestone Co. continued to yield limestone for concrete aggregate, road metal, and agricultural use but at a somewhat reduced output compared with 1953. Coal production was 19,000 tons, compared with 48,900 in 1953.

Muhlenberg.—Greenville Quarries, Inc., continued operations, and Luzerne Limestone reported initial production from its Greenville quarry; both produced crushed limestone for concrete aggregate, road metal, and agricultural use. Coal production was 5.1 million tons, compared with 4.8 million in 1953.

Ohio.—Crushed limestone for concrete aggregate, road metal, and agricultural use was quarried by Fort Hartford Stone Quarry and State Contracting & Stone Co., Inc. (Sulphur Springs quarry); the former also marketed some riprap and railroad ballast; the total county output was somewhat below that in 1953. Coal production was 1.7 million tons, compared with 1.3 million in 1953.

Perry.—Coal production was 4 million tons, compared with 5 million in 1953.

Pike.—Coal production was 5.9 million tons, compared with 8.2 million in 1953.

Powell.—H. B. Sipple Brick Co. increased the production of miscellaneous clay from its Faulkner No. 1 mine from 12,500 tons in 1953 to 19,000 in 1954; the clay was for its own use in manufacturing heavy clay products. A. W. Walker & Son increased the production of crushed limestone slightly from its Powell County quarry; stone was marketed for concrete aggregate, road metal, and agricultural use.

Pulaski.—Strunk Construction Co. (Tatesville quarry) and Somerset Stone Co., Inc. (Somerset quarry), continued to produce crushed limestone for concrete aggregate, road metal, and agricultural use; production was 6 percent above 1953 in tonnage and 16 percent above in total value, reflecting an increase in average value of 13 cents. Coal production was 59,000 tons, compared with 229,000 in 1953.

Rockcastle.—Kentucky Stone Co. continued to produce crushed limestone for concrete aggregate, road metal, railroad ballast, and agricultural use from its Mount Vernon and Mullins quarries; production was roughly 3 percent above 1953 and the total value up 10 percent, reflecting a rise in average unit value. Coal production was 61,000 tons, compared with 109,000 in 1953.

Rowan.—Lee Clay Products Co. (Lee Clay mine) continued the production of clay for its own use in manufacturing heavy clay products. Moorehead Limestone Co. reported initial production of crushed limestone for concrete aggregate, road metal, flux stone, and agricultural use; the total production was 45,000 tons valued at $55,000.

Simpson.—Southern Stone Co., continued to operate its Franklin quarry and reported crushed limestone for concrete aggregate, road metal, and agricultural use amounting to 93,000 tons valued at $121,000, which is 16 percent less tonnage than 1953 but only 8 percent less total value, reflecting an average increase of 12 cents a ton.

Todd.—There were three active producers of crushed limestone for concrete aggregate, road metal, and agricultural use—D. W. Dickinson

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(Gallatin quarry), Kentucky Stone Co. (Elkton quarry), and Todd County Stone Co.; production was 50 percent greater than in 1953 with approximately the same increase in total value.

Trigg.—Cedar Bluff Stone Co., Inc., continued to operate its Cerulean quarry for crushed limestone for concrete aggregate, road metal, and agricultural use; production was substantially above that of 1953.

Union.—Clark's Clay Products Co. (Uniontown mine) continued mining clay for manufacturing heavy clay products; production was somewhat greater than in 1953. Union Sand & Gravel Co. (Morganfield mine) continued to mine and prepare building sand and gravel and paving gravel; production paralleled that of 1953 in tonnage but recorded a substantial increase in average value. Coal production was 1.7 million tons, compared with 1.2 million in 1953.

Warren.—McLellan Stone Co. and Gary Bros. Crushed Stone Co. quarried and crushed limestone for concrete aggregate and road metal, and Gary Bros. Crushed Stone Co. also marketed stone for agricultural use; the total production more than doubled that recorded for 1953.

Wayne.—Bassett Products Co. continued to produce crushed limestone for concrete aggregate, road metal, and agricultural use, but total production was below that of 1953. Coal production was continued.

Webster.—Coal production was continued in Webster County.

Whitley.—Corbin Brick Co. continued to manufacture heavy clay products from clay of its own mining and in 1954 used almost double the quantity consumed in 1953. Coal production was 275,000 tons, compared with 425,000 in 1953.

Wolfe.—Coal production was 9,000 tons, compared with 13,100 in 1953.

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The Mineral Industry of Louisiana

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Louisiana Geological Survey.

By Howard E. Rollman[1] and Leo Hough[2]

THE FIGURATIVE "horn of plenty" might more appropriately be called the "well of plenty" in Louisiana. It is from wells sunk deep into earth that the greatest part of the State mineral riches are taken. Salt, sulfur, natural gas, natural-gas liquids, and petroleum flow from these wells to all parts of the country, serving the energy, industrial, and chemical raw material needs of the economy.

The continuous growth in the mineral industries of Louisiana culminated in the new record production of nearly $1 billion in 1954. This value was roughly as large as that value added by all manufacturing in the State during the year. In the 10-year period beginning in 1945, the value of mineral production tripled—this was double the rate of increase of the United States as a whole.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United Stares Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

The growth of Louisiana mineral industry was due not only to the increased needs of a booming national economy but also to an expanding State economy. Apart from the mineral fuels processed wholly or in part at the State refineries, natural-gasoline and cycle plants, and the petrochemical industries, a quantity of other minerals, such as clays, salt, cement, lime, sand and gravel, and sulfur, were processed to meet the needs of the local industries in Louisiana. According to the 1954 Census of Manufactures, in the period from 1947 to 1954 manufacturing employment has increased 11 percent and the value added by manufacture 70 percent. This industrial expansion explains in part the added output of the Louisiana mineral industry.

The quantitative rate of growth for the principal minerals produced in Louisiana has been better than for the entire United States in the period 1945–54, except for natural-gas liquids and sand and gravel. Although mineral fuels accounted for most of the value of mineral production throughout the 10-year period, nonmetallic-mineral value was sizable also. In 1945 and 1954 nonmetallics constituted about

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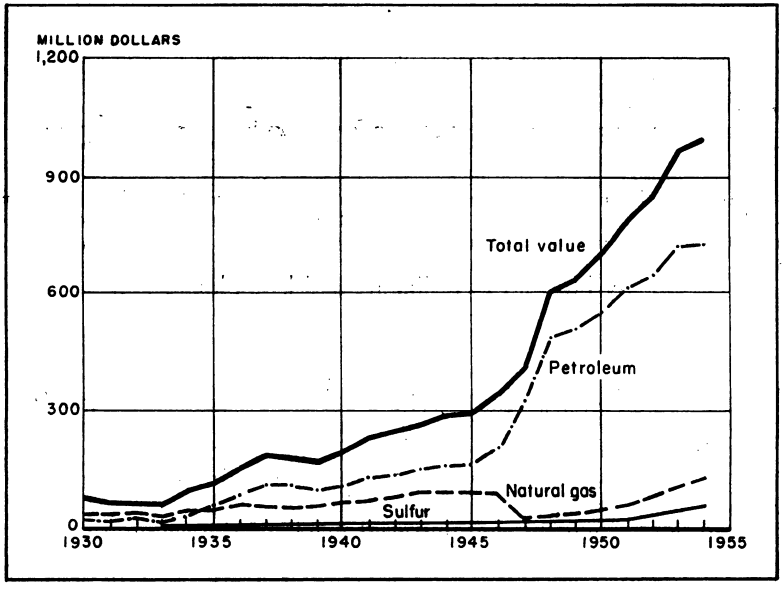

FIGURE 1.—Value of petroleum, natural gas, sulfur, and total value of mineral production in Louisiana, 1930–54.

8 percent of total value. Part of the large increase in total value is attributable to an increase in the average unit value of the various commodities but the quantities produced were steadily increasing as well.

Minerals were produced in 1954 in all but 2 of the State's 64 parishes (counties). Mineral fuels were produced in a total of 59 parishes and all other minerals in 30 parishes. Louisiana ranked second in the Nation in the quantities of Frasch sulfur and natural gas produced and third in the output of natural-gas liquids, petroleum, and salt. In addition large quantities of cement, lime, and oystershells and small amounts of gypsum and elemental sulfur were produced.

Employment.—Employment in the petroleum industry has been growing steadily. The number of people employed in producing petroleum and natural gas, for example, more than doubled in the period 1945–54. The number of petroleum and gas processing, transportation, and market-distribution workers also has increased substantially. The total wage and salaried employees in petroleum-production, refining, and related industries (including the growing petrochemical industry) have advanced from 46,450 in 1945 to 75,400 in 1954, an increase of 62 percent in the 10-year period.

Average weekly earnings in the petroleum industry in 1954 were $93.42 compared with $53.77 in 1945. Earnings in the petroleum industry have grown from $325 million in 1953 to $356 million in 1954.

Employment in the nonmetallic mining industry in 1954 totaled 3,900 workers. Except for 2 early years of postwar adjustment, employment in nonmetallics has expanded an average of 6 percent in the period 1945–54. Sulfur and salt producers are the largest users of labor in this nonmetallic group.

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TABLE 1.—Mineral production in Louisiana, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	624,427	$951,612	[2] 713,940	[2] $940,940
Natural gas.....million cubic feet	1,293,644	106,079,000	1,399,222	124,531,000
Natural-gas liquids:				
Natural gasoline and cycle products.....thousand gallons	665,532	55,421,000	665,070	54,330,000
LP-gases.....do	287,280	12,554,000	292,226	11,620,000
Petroleum (crude).....thousand 42-gallon barrels	256,632	721,150,000	246,558	722,370,000
Salt (common)	3,061,234	9,189,526	3,088,686	11,101,456
Sand and gravel	4,538,387	5,162,248	7,910,152	9,686,635
Sulfur (Frasch process).....long tons	1,609,364	43,453,000	1,853,563	49,222,394
Undistributed: Bentonite (1954), cement, gypsum, lime, stone (1954), and elemental sulfur		11,176,929		13,426,741
Total Louisiana		965,237,000		[3] 996,978,000

[1] Production is measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes bentonite which is included with "Undistributed."
[3] Total value adjusted to avoid duplication of clays and stone.

Accidents.—There were 10 fatal or permanently disabling accidents and 692 nonfatal accidents in exploration, drilling, production, transportation, and processing oil and gas in Louisiana in 1954. The injury rate was 1 accident for every 64,000 man-hours worked.

TABLE 2.—Total number of wage and salaried workers in petroleum production, refining, and related industries, 1944–54 [1]

Year	Crude-petroleum and natural-gas production	Petroleum refining	Pipeline transportation (except natural gas)	Gas utilities	Petroleum bulk tank stations	Retail filling stations	Chemicals manufactured as by-products of petroleum or used in refining petroleum	Total
1944	13,577	12,663	1,256	2,486	1,901	3,592	8,573	44,048
1945	15,244	13,741	1,277	2,523	1,821	3,744	8,120	46,470
1946	16,843	14,069	1,363	2,778	2,087	4,245	7,465	48,850
1947	18,181	15,254	1,383	3,203	2,989	4,772	8,207	53,989
1948	21,713	15,837	1,579	3,627	2,896	4,364	8,440	58,456
1949	23,758	14,988	1,417	4,003	3,010	4,374	7,688	59,238
1950	23,584	14,871	1,352	4,117	3,242	4,681	8,181	60,028
1951	24,574	15,407	1,421	4,440	3,157	5,138	9,392	63,529
1952	26,442	16,039	1,544	4,660	3,157	5,572	9,688	67,102
1953	28,450	15,900	1,500	4,900	3,500	6,250	10,350	70,850
1954	31,900	15,900	1,450	5,200	3,650	6,600	10,700	75,400

[1] Louisiana State Department of Labor.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Mineral fuels produced in Louisiana had considerable importance to the economies of both the State and the Nation as raw materials for energy. The petroleum and natural-gas industry was important to the State, not only because of the employment and income derived directly from production but also because of the economic growth resulting from the refining, chemical, and other manufacturing indus-

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tries attracted to the State by these abundant fuels. Louisiana ranked second among the States in natural-gas production and third in crude-petroleum output. Reflecting trends in the United States as a whole in 1954, crude-petroleum production declined and output of natural gas and natural-gas liquids increased in the State.

Carbon Black.—Carbon-black production declined 2 percent in 1954, compared with 1953, for a total of 368 million pounds valued at $21.6 million. Production for the Nation as a whole declined 12 percent. The average price of carbon black per pound for Louisiana remained at 5.9 cents, the same as in 1953. Reduced sales to the rubber industry due to a strike in that industry, as well as curtailed automobile production, were responsible for the slight decline in production. Furnace black composed 99.8 percent of the carbon black produced in 1954. The following table shows the trend in production for the past 5 years:

Year:	*Pounds*
1950	226, 177, 000
1951	258, 989, 000
1952	255, 939, 000
1953	376, 818, 000
1954	368, 233, 000

There were only 6 producing companies in the State in 1954, compared with 7 in 1953.

A new oil-black plant constructed by Columbian Carbon Co. near Franklin went on stream with an annual capacity of 20 million pounds. Capacity will be three times as great when design capacity was reached. Feedstock for the plant includes both oil barged to the plant from Gulf coast refineries and natural gas from nearby fields.[3]

Natural Gas.—The marketed production of natural gas continued its strong, steady growth in the State, with an 8-percent increase in quantity and a 17-percent increase in value for a record of 1,400,000 million cubic feet valued at $125 million. Louisiana ranked second in the Nation in marketed production of natural gas.The average value at the well increased from 8.2 cents per thousand cubic feet to 8.9 cents in 1954. The consumption of natural gas was as follows:

Use:	*Quantity (million cubic feet)*	*Value at point of consumption*
Residential	34, 842	$21, 218, 778
Commercial	14, 404	5, 257, 460
Industrial:		
Field (drilling, pumping, etc.)	144, 052	10, 419, 000
All other industrial:		
Fuel for petroleum refineries	96, 702	
Other, including electric utility plants	346, 704	61, 440, 000

There were 510,000 residential consumers and 44,000 commercial consumers. The State uses 69,662 million cubic feet of gas for its electric plants. Some manufactured gas may be included in this figure; separate data are not available.

Out-of-State deliveries of natural gas from Louisiana in 1954 were 859,924 million cubic feet; deliveries into the State in the same period were 94,331 million cubic feet.

[3] Oil and Gas Journal, vol. 53, No. 30, Nov. 29, 1954, p. 49.

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TABLE 3.—Marketed production of natural gas, 1945–49 (average) and 1950–54 [1]

Year	Million cubic feet	Value	Value per thousand cubic feet (mills)	Year	Million cubic feet	Value	Value per thousand cubic feet (mills)
1945–49 (average)	613,654	$23,528,400	38	1952	1,237,143	$82,889,000	67
1950	831,771	44,084,000	53	1953	1,293,644	106,079,000	82
1951	1,054,199	61,143,000	58	1954	1,399,222	124,531,000	89

[1] Comprises gas either sold or consumed by producers including losses in transmission, amounts added to storage, and increases in gas pipelines.

At the end of 1954 (according to the American Gas Association), Louisiana had 16,660 miles of natural-gas utility mains, including field, gathering, transmission, and distribution mains. Mileage for various types of mains is as follows:

Field and gathering	1,880
Transmission	8,330
Distribution	6,450

Below is mileage of natural-gas utility mains for the past 5 years with the 1945–49 average.

1945–49 (average)	8,556	1952	13,890
1950	11,160	1953	14,940
1951	12,950	1954	16,660

Natural-gas reserves.—Natural gas-reserves increased 7 percent in 1954 for a total of 36,799,986 million cubic feet. Of this, 29,276,768 million cubic feet was free gas not in contact with crude oil in res-

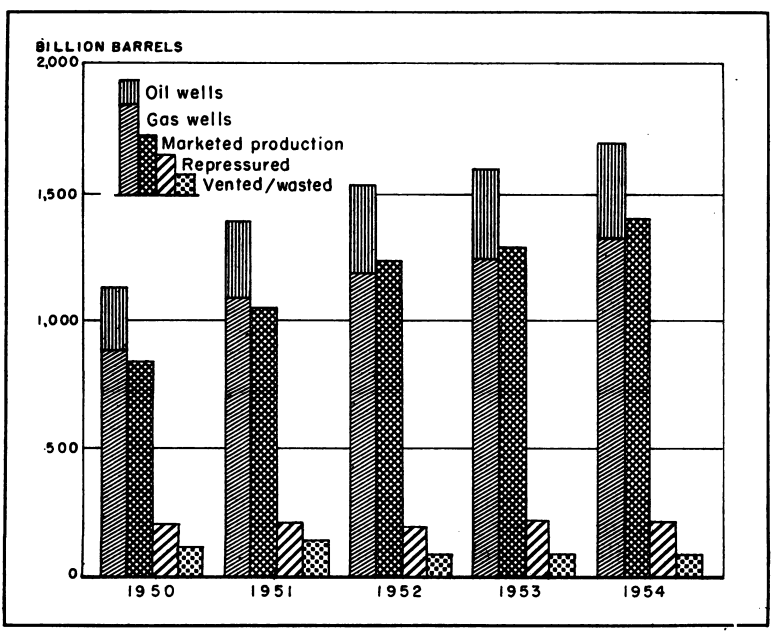

FIGURE 2.—Gross withdrawals and disposition of natural gas in Louisiana, 1950–54.

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ervoirs, 4,939,363 million cubic feet was free gas in contact with crude oil in reservoirs, and 2,583,855 was gas in solution with crude oil in reservoirs. Of the gross changes in reserves, 2,595,319 million cubic feet was from extensions of old pools or revisions of estimates and 1,252,836 from discoveries of new fields or new pools in old fields. In terms of extensions and new discoveries and net increase in reserves (new reserves less production), Louisiana led the Nation in 1954.[4]

Natural-Gas Liquids.—Production of natural-gas liquids increased slightly in 1954, but declining prices resulted in a 3-percent lower total value. Production of natural gasoline and cycle products remained approximately the same as in 1953, but LP-gases recovered a little from the downward trend in 1953. Prices of both natural gasoline and LP-gases in Louisiana were weak during the first part of the year but improved later in the year. The State ranked third in the Nation in production of natural-gas liquids.

There was a sharp decrease in the quantity of LP-gases used for the production of synthetic rubber and a moderate decline in use for domestic and commercial purposes. LP-gases for chemical uses increased 41 percent in 1954. Butane almost entirely supplanted propane as a chemical raw material for the petrochemical industries during 1954. Propane consumption for this use dropped from 115.1 million to 3.8 million gallons in 1954. Butane was marketed for chemical uses for the first time in 1954. Chemical use consumption was 159 million gallons. The following is a distribution of LP-gases sales by type:

	Thousand gallons	
Type:	*1953*	*1954*
Butane	89, 801	198, 391
Propane	139, 190	31, 546
Mixture	77, 165	80, 255
Total	306, 156	310, 192

Industrial uses of LP-gases increased more than three times that of 1953. The following table shows the utilization of LP-gases in Louisiana in 1953 and 1954:

	1953	*1954*
Domestic and commercial	82, 100	73, 862
Gas manufacturing	565	180
Industrial	3, 235	10, 922
Synthetic rubber	81, 194	37, 206
Chemical	115, 104	162, 777
Internal combustion	23, 847	25, 111
All other	111	134
Total	306, 156	310, 192

An important conservation move was made when The Texas Co. placed on stream its new Paradis gasoline plant near New Orleans. The project utilizes oil-well gas from virtually inaccessible wells in southern Louisiana marshes and bays that might otherwise be wasted.

[4] American Petroleum Institute.

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TABLE 4.—Natural-gas liquids produced, 1945–49 (average) and 1950–54, in thousand gallons

Year	Natural gasoline and cycle products		LP-gases		Total	
	Thousand gallons	Value	Thousand gallons	Value	Thousand gallons	Value
1945–49 (average)	494, 294	$29, 905, 800	158, 384	$7, 384, 200	652, 678	$37, 290, 000
1950	613, 326	44, 548, 000	258, 930	7, 991, 000	872, 256	52, 539, 000
1951	657, 006	49, 202, 000	287, 238	15, 374, 000	944, 244	64, 576, 000
1952	672, 042	48, 579, 000	297, 444	14, 890, 000	969, 486	63, 469, 000
1953	665, 532	55, 421, 000	287, 280	12, 654, 000	952, 812	68, 075, 000
1954	665, 070	54, 330, 000	292, 226	11, 620, 000	957, 296	65, 950, 000

Eighty-eight miles of trunk-gathering lines bring the gas from field compressor stations, two of which were floated in on barges and sunk at the field location. The plant is designed to recover 90 percent of total butanes and 40 percent of propane. After the liquid content is removed, much of the gas will go to the new ammonia plant of the American Cyanamid Co. and Lion Oil Co. new petrochemical plant nearby on the Mississippi River.[5]

The position of the State in proved reserves of natural-gas liquids was strengthened in 1954 with addition of 70.8 million barrels, for a total of 884 million barrels. During this period, the Nation as a whole experienced a decline of 193.5 million barrels in reserves. These increases to reserves were the largest by far for any State.[6]

Petroleum.—A high level of stocks, and a lagging demand for crude oil and refined products caused crude-oil production to decline. Although the percentage decrease in Louisiana was larger than for the United States as a whole, production was the second largest for any year in the State history. In most months, production was lower than for the previous year. Indicated demand appeared to be less firm during the second half of the year. Higher prices per barrel of crude, however, gave a larger total value of petroleum production than in the previous year. The State ranked third in the Nation in quantity of crude production.

TABLE 5.—Production of crude petroleum, 1945–49 (average) and 1950–54

Year	Thousand 42-gallon barrels	Value		Year	Thousand 42-gallon barrels	Value	
		Total	Average per barrel			Total	Average per barrel
1945–49 (average)	161, 426	$336, 756, 000	$2. 09	1952	243, 929	$645, 090, 000	$2. 64
1950	208, 965	554, 520, 000	2. 65	1953	256, 632	721, 150, 000	2. 81
1951	232, 281	614, 680, 000	2. 65	1954	246, 558	722, 370, 000	2. 93

[5] Oil and Gas Journal, vol. 53, No. 29, Nov. 22, 1954, pp. 100–107.
[6] American Gas Association and American Petroleum Institute, Proved Reserves of Crude Oil, Natural Gas Liquids and Natural Gas: Vol. 9, Dec. 31, 1954, p. 19.

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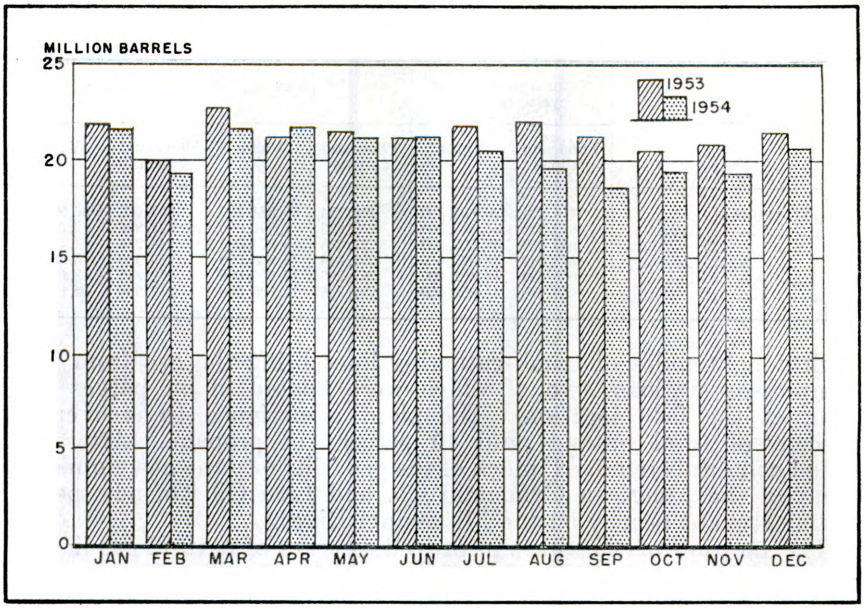

FIGURE 3.—Production of crude petroleum in Louisiana, by months, 1953–54.

TABLE 6.—Indicated demand for petroleum in 1954, by months, in 42-gallon barrels

Month	Indicated demand, barrels	Month	Indicated demand, barrels
January	23,114,000	July	20,515,000
February	20,388,000	August	20,649,000
March	22,322,000	September	19,190,000
April	19,708,000	October	20,001,000
May	21,966,000	November	19,364,000
June	21,133,000	December	20,617,000

TABLE 7.—Production of crude petroleum, 1950–54, by districts and fields

(Thousand barrels)

District and field	1950	1951	1952	1953	1954 [1]
Gulf Coast:					
Anse la Butte	2,194	2,442	2,373	2,165	1,699
Avery Island	2,649	3,018	3,090	3,111	2,724
Barataria	3,450	3,294	2,876	2,351	1,628
Bay de Chene	815	1,259	1,288	1,302	1,208
Bay Marchand	1,986	2,428	2,004	1,560	2,430
Bay St. Elaine	2,230	2,672	2,733	3,194	3,130
Bayou Blue	1,071	1,122	1,156	1,158	1,060
Bayou Mallett	874	1,253	1,604	1,796	1,413
Bayou Sale	4,737	5,139	5,199	4,710	3,589
Bully Camp	339	867	1,250	1,640	1,353
Caillou Island	5,335	6,499	7,136	8,540	8,398
Charenton	1,361	1,136	1,176	1,278	1,223
Cox Bay	29	1,123	2,102	2,700	3,413
Delta Farms	7,648	7,190	6,751	6,480	5,456
Dog Lake	901	1,320	1,276	1,530	1,270
Duck Lake	414	1,123	2,269	2,935	3,199
East White Lake	1,321	1,443	1,427	1,479	1,179

For footnotes, see end of table.

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TABLE 7.—Production of crude petroleum, 1950–54, by districts and fields—Con.
(Thousand barrels)

District and field	1950	1951	1952	1953	1954 [1]
Gulf Coast—Continued					
Egan	2,136	2,083	2,041	2,017	2,117
Erath	1,214	1,178	1,179	1,370	1,152
Garden Island	1,614	1,583	1,590	1,590	1,419
Gibson	1,539	1,460	1,498	1,410	1,140
Golden Meadows	5,020	4,864	4,546	3,918	3,974
Good Hope	2,240	2,434	2,288	2,045	1,446
Grand Bay	3,766	3,853	3,638	3,768	3,519
Gueydan	2,217	2,325	1,970	1,570	1,298
Hackberry	3,519	3,621	3,780	4,512	4,215
Horseshoe Bayou	1,246	1,346	1,303	1,394	1,097
Iowa	1,947	2,282	2,513	2,842	2,701
Jeanerette	947	1,067	1,084	1,137	1,228
Lafitte	4,332	4,489	4,467	4,650	3,686
Lake Chicot	1,031	1,105	1,104	1,072	1,021
Lake Pelto	1,625	2,173	2,456	2,697	2,324
Lake Salvador	1,972	2,086	1,843	1,831	1,415
Lake Washington	157	352	380	951	1,947
Leeville	2,112	2,205	2,417	3,251	3,556
Main Pass	1,331	2,057	2,445	4,287	4,981
New Iberia	1,462	1,470	1,275	1,241	979
North Crowley	1,767	1,659	1,390	1,504	1,273
Paradis	3,649	3,626	3,411	3,445	3,379
Phoenix Lake	148	614	1,507	1,781	1,778
Pine Prairie	1,168	1,048	984	955	864
Point-a-La Hache	1,603	2,484	2,746	2,689	2,451
Port Barre	1,470	1,438	1,285	1,327	1,056
Quarantine Bay	3,725	3,960	3,480	3,151	2,649
Romre Pass	606	2,315	3,641	4,570	4,719
St. Gabriel	1,577	1,793	2,095	1,778	1,278
Section 28	1,296	1,117	1,343	1,244	1,335
Sunshine	771	1,257	979	790	652
Tepstate	3,788	3,321	2,647	2,149	1,722
Timbalier Bay	57	368	1,731	2,514	2,289
University	2,840	2,203	1,811	1,534	1,391
Valentine	518	651	902	1,252	1,379
Venice	5,001	5,742	5,965	5,728	5,364
Ville Platte	1,888	1,462	1,424	1,335	1,402
Vinton	3,872	3,960	3,786	3,618	2,712
Weeks Island	5,183	8,199	10,680	11,258	9,029
West Bay	2,404	2,936	3,123	3,132	2,525
West Cote Blanche	1,704	2,392	2,830	2,865	2,380
West Lake Verrett	1,472	1,782	1,966	1,757	1,517
White Castle	1,692	1,672	1,563	1,343	941
Other Gulf Coast [2]	37,775	45,408	49,203	56,929	61,049
Total Gulf Coast	164,755	188,768	200,019	214,130	204,721
Northern:					
Big Creek	1,443	1,468	1,432	1,279	900
Caddo	5,689	4,995	5,111	5,438	8,251
Delhi	6,733	6,679	6,436	5,916	4,880
Haynesville	5,444	5,480	5,008	4,445	3,694
Lake St. John	6,695	5,871	4,870	4,015	3,162
Nebo [3]	2,328	2,302	2,272	2,268	2,270
Olla [4]	2,490	2,294	2,203	2,106	1,934
Rodessa	1,186	1,043	934	868	784
Other Northern [3]	12,202	13,381	15,644	16,167	15,962
Total Northern	44,210	43,513	43,910	42,502	41,837
Total Louisiana	208,965	232,281	243,929	256,632	246,558

[1] Final figures.
[2] Includes crude oil consumed on leases and net change in stocks held on leases for entire district.
[3] Includes Hemphill, Trout Creek, and Jena.
[4] Includes Little Creek and Summerville.

TABLE 8.—Sales of petroleum products, 1950–54, in thousand 42-gallon barrels

Product	1950	1951	1952	1953	1954
Gasoline [1]	13,196	14,303	15,510	16,742	17,572
Kerosine	1,522	1,550	1,572	1,425	1,348
Range oil	964	1,050	1,051	[2] 664	675
Distillate fuel oil	4,619	5,224	5,840	6,212	6,242
Residual fuel oil	11,158	10,917	10,407	[2] 9,929	9,712

[1] Gasoline consumption from American Petroleum Institute.
[2] Revised figure.

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In spite of a decline in production, a substantially larger drilling program yielded larger quantities of total reserves. Data include offshore reserves. Nearly one-third of the Nation's increase in crude oil reserves in 1954 was developed in Louisiana. According to the American Petroleum Institute, proved reserves of crude oil in Louisiana, as of December 31, 1954, were 2,962 million barrels, a net increase of 202 million barrels in one year. Of the gross increase, 276 million barrels was due to extensions and revisions of proved reserves, and 153 million barrels resulted from discoveries in new fields and new pools in old fields. The growth in reserves of crude petroleum is illustrated in figure 4.

At the end of the year 20,000 wells were capable of producing oil and/or gas in 600 fields.[7]

Although reserves have been increasing, it is becoming more difficult to achieve these increases in reserves. A large part of the more readily accessible petroleum reservoirs has been explored. It is becoming necessary to drill more exploratory wells to greater depths to find the oil. In addition, for every well in Louisiana, producing crude petroleum, natural gas, or natural-gas liquids three dry, unproductive holes were drilled. Figure 5 shows the decreasing yields in reserves per foot of exploratory holes drilled for the United States. The increase in total exploratory drilling in recent years is illustrated in table 10. These figures demonstrate increases of 56 percent in wells drilled, 80 percent in footage drilled, and 16 percent in the average depth of completed wells in the period 1949–54.

Offshore drilling. In all, 233 offshore wells were drilled in 1954. In addition, 72 were being drilled or on location at the end of the year. Well completions resulting from offshore drilling activity for the past 3 years follow:

Year	Oil	Gas	Dry	Total
1952	45	4	11	60
1953	53	5	15	73
1954	149	25	59	233

All 26 exploratory wells completed in 1954 were dry holes.[8]

Refineries.—At the end of the year, 16 refineries were manufacturing petroleum products; they had a total operating capacity of 643,500 barrels of crude per day and a daily capacity of 160,155 barrels of cracked gasoline.

Cities Service Refining Corp. was completing a $22 million expansion program of its Lake Charles refinery. A 17,250-barrel hydroforming unit was the main feature of the program and will allow the company to produce larger quantities of aviation gasoline and jet fuel. Major process equipment was also added to older units of the refinery.[9]

[7] Department of Conservation, State of Louisiana, Annual Oil and Gas Report: 1954, p. 7.
[8] Work cited in footnote 7.
[9] Oil and Gas Journal, vol. 53, No. 6, Nov. 1, 1954, p. 65.

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TABLE 9.—Oil- and gas-well drilling in 1954, by parishes [1]

Parish	Proved field wells			Exploratory wells			Total		
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry
Acadia	22	25	2	1	9	25	23	34	27
Allen	15	1	1	1	1	9	16	2	10
Ascension	3	-----	4	1	1	-----	4	1	4
Assumption	8	6	6	2	4	3	10	10	9
Avoyelles	-----	-----	1	-----	-----	2	-----	-----	3
Beauregard	8	1	-----	1	2	22	9	3	22
Bienville	1	7	2	1	2	2	2	9	4
Bossier	53	18	14	3	2	18	56	20	32
Caddo	1,179	40	72	1	3	9	1,180	43	81
Calcasieu	30	13	17	3	1	14	33	14	31
Caldwell	-----	-----	-----	-----	-----	1	-----	-----	1
Cameron	35	29	16	5	8	21	40	37	37
Catahoula	2	-----	1	2	-----	14	4	-----	15
Claiborne	18	4	14	3	-----	4	21	4	18
Concordia	48	-----	29	5	-----	44	53	-----	73
De Soto	14	11	23	1	5	11	15	16	34
East Baton Rouge	5	-----	3	-----	-----	3	5	-----	6
East Carroll	-----	2	3	-----	-----	2	-----	2	5
East Feliciana	-----	-----	-----	-----	-----	1	-----	-----	1
Evangeline	3	-----	2	-----	-----	3	3	-----	5
Franklin	1	1	5	-----	-----	3	1	1	8
Grant	2	-----	1	1	-----	8	3	-----	9
Iberia	59	7	11	1	3	8	60	10	19
Iberville	22	7	5	3	1	7	25	8	12
Jackson	-----	-----	-----	-----	-----	3	-----	-----	3
Jefferson	41	3	8	1	2	6	42	5	14
Jefferson Davis	14	10	-----	2	2	17	16	12	17
Lafayette	3	-----	-----	1	2	2	4	2	2
Lafourche	135	10	44	1	8	8	136	18	52
La Salle	16	-----	10	1	-----	11	17	-----	21
Lincoln	-----	8	5	-----	1	3	-----	9	8
Madison	1	-----	-----	-----	-----	1	1	-----	1
Morehouse	-----	-----	-----	-----	-----	1	-----	-----	1
Natchitoches	6	-----	2	-----	-----	3	6	-----	5
Ouachita	-----	-----	-----	-----	1	2	-----	1	2
Plaquemines	230	15	41	14	3	29	244	18	70
Pointe Coupee	7	3	9	-----	-----	2	7	3	11
Rapides	-----	-----	-----	-----	-----	6	-----	-----	6
Red River	5	-----	3	-----	-----	11	5	-----	14
Richland	11	3	10	-----	1	8	11	4	18
Sabine	3	-----	14	-----	-----	4	3	-----	18
St. Bernard	2	3	5	1	2	7	3	5	12
St. Charles	17	-----	8	2	-----	2	19	-----	10
St. James	4	2	1	1	-----	1	5	2	2
St. John the Baptist	-----	-----	-----	-----	-----	2	-----	-----	2
St. Landry	15	8	8	2	5	29	17	13	37
St. Martin	23	7	12	2	3	10	25	10	22
St. Mary	39	7	7	1	1	13	40	8	20
St. Tammany	-----	-----	-----	-----	-----	1	-----	-----	1
Tensas	8	-----	2	1	2	2	9	2	4
Torrebonne	104	31	31	5	9	8	109	40	39
Union	-----	39	1	-----	1	4	-----	40	5
Vermillion	7	8	1	1	5	14	8	13	15
Vernon	-----	-----	-----	-----	-----	1	-----	-----	1
Webster	50	12	8	3	2	8	53	14	16
West Baton Rouge	1	-----	3	-----	-----	3	1	-----	6
West Carroll	-----	6	4	-----	-----	1	-----	6	5
Winn	14	-----	8	1	-----	6	15	-----	14
Gulf of Mexico:									
East Cameron area	-----	-----	-----	-----	1	3	-----	1	3
Eugene Island area	8	7	2	5	1	1	13	8	3
Vermillion area	-----	1	-----	-----	1	-----	-----	2	0
West Cameron	-----	8	1	1	1	3	1	9	4
Total Gulf of Mexico	8	16	3	6	4	7	14	20	10
Total: 1954	2,292	363	480	81	96	470	2,373	459	950
1953	1,386	330	581	87	63	379	1,473	393	960

[1] National Oil Scouts & Landmen's Association, Oil- and Gas-Field Development in United States: Vol. 25, 1955, Austin, Tex.

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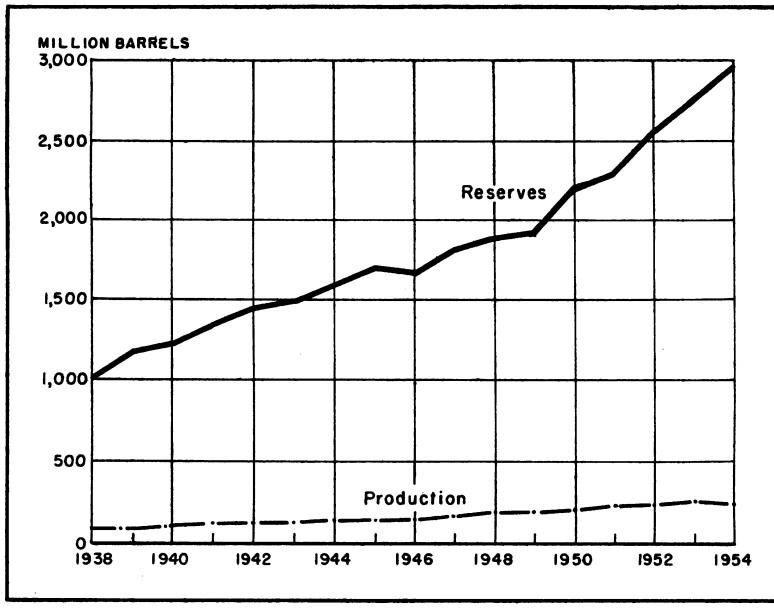

FIGURE 4.—Growth of crude-petroleum reserves, compared with marketed production, 1938–54

TABLE 10.—Number of exploratory holes and footage drilled, 1949–54 [1]

Year	Total, all exploratory wells			Crude-petroleum producers		
	Number of wells	Footage	Average depth	Number of wells	Footage	Average new well depth
1949	437	3,461,878	7,922	71	614,909	8,660
1950	473	3,703,055	7,829	59	516,229	8,750
1951	653	4,675,986	7,161	122	818,695	6,710
1952	691	5,537,473	8,014	86	710,172	8,258
1953	627	5,624,090	8,970	98	911,913	9,305
1954	681	6,235,309	9,156	94	916,828	9,753

[1] Lahee, Frederick H., Petroleum Facts and Figures (9th and 12th editions): Bull. Assoc. Petrol. Geol.

The expansion and modernization program of the Lake Charles refinery of the Continental Oil Co. was completed, increasing the capacity to 45,000 barrels per stream day, 4½ times the original capacity. The expansion makes the refinery one of the most diversified in the country. Included in the $16 million program was a new 30,000-barrel-per-day atmospheric crude topping unit and a modification of the original topping unit to increase its capacity from 12,000 barrels per day to 16,000. The company was the first to extract benzene, toluene, and xylene simultaneously from petroleum by the sulfur dioxide process.[10]

Sales of petroleum asphalt increased 51 percent in 1954 compared with 1953. Of the total, 43 percent was used for paving products, 49

[10] Oil and Gas Journal, vol. 53, No. 16, Aug. 23, 1954, p. 168.

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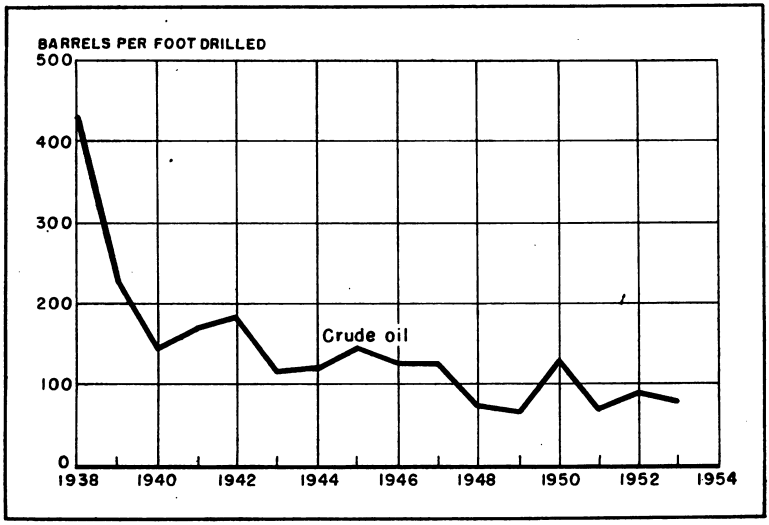

FIGURE 5.—Additions to petroleum reserves in Louisiana per foot of exploratory wells drilled, 1938–54

NOTE: Chart data furnished by Lahee, Frederic H., Committee on Statistics of Exploratory Drilling, American Association of Petroleum Geologists; Reserves Committee, American Petroleum Institute; in Monthly Business Review, Federal Reserve Bank of Dallas, vol. 39, No. 9, Sept. 1, 1954, p. 130.

TABLE 11.—Capacity of petroleum refineries and cracking plants at end of 1954, in barrels per day

Company	Location	Crude-oil capacity, operating	Cracked-gasoline capacity, operating
Inland:			
Bayou State Oil Corp	Hosston	1,000	
Calumet Refining Co	Princeton	900	
Cotton Valley Solvents, Inc	Cotton Valley	4,000	
Great National Refining Co	Ida	800	
Stanolind Oil & Gas Co [1]	Superior	6,200	2,680
Gulf:			
Bay Petroleum Corp	Chalmette	18,000	3,500
Breaux Bridge Oil Refining Co	Anse La Butte	1,000	780
Canal Refining Co	Church Point	1,000	750
Cities Service Refining Corp	Lake Charles	175,000	41,400
Clark Oil & Refining Corp	Marrero	[2] 6,500	900
Continental Oil Co	West Lake (Lake Charles)	47,500	15,245
Esso Standard Oil Co	Baton Rouge	[3] 265,600	[4] 56,300
Evangeline Refining Co., Inc	Jennings	1,000	
Ingram Products Co	Meraux	10,000	2,700
Pan-Am Southern Corp	Destrehan	30,000	9,200
Shell Oil Co	Norco	75,000	26,700
Total		643,500	160,155

[1] Sold to Pan-Am Southern Corp. Apr. 1, 1955, and shut down indefinitely.
[2] In addition 1,000 barrels per day, building.
[3] In addition 49,400 barrels, shut down.
[4] In addition 8,100 barrels, shut down.

percent for roofing products, and 8 percent for all other purposes. Sales for asphalt cement and fluxes were 328,100 short tons, 10,500 short tons was emulsified asphalts, and 25,200 short tons was cutback asphalts. The sales of asphalt cement for roofing products increased 82 percent in 1954, and paving-product sales increased 37 percent.

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TABLE 12.—Sales of petroleum asphalts, by types and uses, 1953–54, in short tons

Type and use	1953	1954
Paving products:		
Asphalt cements	87,243	121,123
Cutback asphalts	16,514	25,251
Emulsified asphalts	10,412	10,184
Total	114,169	156,558
Roofing products:		
Asphalt cements and fluxes	97,845	177,598
Emulsified asphalts	7	5
Total	97,852	177,603
All other products:		
Asphalt cements and fluxes	15,059	29,382
Emulsified asphalts	13,771	277
Total	28,830	29,659
Grand total	240,851	363,820

Petrochemicals.—One of the most important segments of the State economy, resulting from the abundance of oil and natural gas, has been the growing petrochemical industry. The Gulf coast of Texas and Louisiana is rapidly becoming a leader in the chemical industry of the United States.

The new plants constructed in Louisiana includes a new petrochemical plant costing $4 million, opened by the Foster Grant Co. Inc., at Baton Rouge for the production of styrene monomer. The new plant will turn out about 2 million pounds of styrene each month. The company is one of the leading producers of molded thermoplastic products and the first to develop its own supply of raw materials.[11]

The new American Cyanamid $50 million Fortier plant also was dedicated during 1954. This versatile petrochemical plant, 18 miles upstream from New Orleans, was designed to use natural gas in producing acrylonitrile, acetylene, hydrocyanic acid, ammonia, sulfuric acid, oxygen, and ammonium sulfate.[12]

Construction was begun on a $5 million nitroparaffin plant at Sterlington, La., by Commercial Solvents Corp. near the company ammonia, nitric acid, and methonal units. The plant was scheduled to go on stream in August, 1955.[13]

At Luling, La., the Lion Oil Co. began to operate its new petrochemical plant, which has a designed capacity of 300 tons of anhydrous ammonia per day. Raw materials are natural gas, air, and water. A large part of the anhydrous ammonia is made into pelleted ammonium nitrate for use as fertilizer. The company announced plans for constructing an ammonia plant for manufacturing nitrogen-fertilizer solutions.[14]

NONMETALS

In addition to the nonmetals produced in Louisiana, crude perlite shipped into the State was expanded by two companies for use as plaster and lightweight concrete aggregate. Exfoliated vermiculite

[11] Oil and Gas Journal, vol. 53, No. 1, May 10, 1954, p. 186.
[12] Oil and Gas Journal, vol. 53, No. 7, June 21, 1954, p. 188.
[13] Petroleum Engineer, vol. 25, No. 12, November, 1954, p. C-63.
[14] Oil and Gas Journal, vol. 53, No. 27, Nov. 8, 1954, p. 199.

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also was processed from material brought in from other areas. Another plant processing raw material from out-of-State was the barite crushing and grinding plant near New Orleans.

Cement.—The two cement plants in the State were at New Orleans and Baton Rouge. Oystershell used as the basic raw material at Ideal Cement Co. mill at Baton Rouge was dredged from coastal shell reefs. Limestone imported from another State was used at the Lone Star New Orleans plant. New 100,000-barrel cement silos were completed at the New Orleans mill during the year. An Ideal Cement Co. expansion program included construction of additional storage capacity at the Baton Rouge plant.

Production and shipments of cement increased more than 10 percent in 1954. A small price increase for cement was in line with trends in the Southwest. Because of continued strong demand for cement, cement stocks increased very little.

Clays.—In 1954 there were 12 producers of heavy clay products in 11 parishes using over 700,000 tons of miscellaneous clay from Louisiana as a raw material. In addition to these structural clay products, miscellaneous clay was used in manufacturing cement, and for producing expanded clay lightweight aggregate at plants at Alexandria and at Erwinville near Baton Rouge. Bentonite for filtering and decolorizing oils was produced in Lincoln Parish.

Clay production in Louisiana has been steadily increasing in recent years. Tonnage in 1954 was about 16 percent higher than in 1953.

TABLE 13.—Miscellaneous clay sold or used by producers, 1945–49 (average) and 1950–54 [1]

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	191,841	$150,515	1952	390,136	$433,808
1950	327,067	273,116	1953	614,427	901,612
1951	306,542	306,542	1954	713,940	940,940

[1] Excludes bentonite.

Gypsum and Lime.—Crude gypsum was produced in Winn Parish. Tonnage and average unit value increased during the year. Lime for chemical and industrial uses was produced by the Olin Mathieson Chemical Corp. at its plant in Calcasieu Parish for its own use.

Oystershell.—Although figures on the tonnage of oystershell dredged from coastal reefs are based upon an incomplete canvass, it is estimated that much more than 1 million tons was produced during 1954. Most of the shell was used for cement and lime and as concrete aggregate.

Salt.—The quantity of salt produced from underground mines and from wells in the large salt domes of Louisiana was the third largest in the Nation. Eight producers recovered salt in Calcasieu, Iberia, Iberville, St. Martin, and Winn Parishes. Over 70 percent of the output was sold or used as a chemical raw material for chlorine, soda ash, soap, and detergents and other chemical uses.

Owing to increased use as a chemical raw material in 1954 as compared with 1953, Louisiana salt production increased 1 percent. Total tonnage was 3.1 million short tons valued at $11.1 million. The quantity of evaporated salt and rock salt increased, but the volume of brine decreased a little. Rocksalt values per ton increased from

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$6.18 in 1953 to $6.38, and the value of evaporated salt increased 13 percent to $14.70 per ton.

TABLE 14.—Production of salt, 1953–54 by type, in short tons

Type	1953		1954	
	Short tons	Value	Short tons	Value
Evaporated salt	121,410	$1,580,290	124,558	$1,831,480
Rock salt	930,740	5,749,102	989,224	6,307,626
Brine [1]	2,009,084	1,860,134	1,974,904	2,962,350

[1] The difference in value per ton of brine in 1953 and 1954 is due in part to revisions in 1954 book values of brines produced by a company for its own consumption.

TABLE 15.—Salt sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	1,984,584	$5,451,859	1952	2,553,448	$7,807,693
1950	2,278,811	6,902,502	1953	3,061,234	9,189,526
1951	2,727,149	7,662,179	1954	3,088,686	11,101,456

Sand and Gravel.—Sand and gravel production was reported by 46 commercial operators in 19 parishes scattered throughout the State. Total tonnage in 1954 was 7.9 millions valued at $9.7 million.

The increase in 1954 was due to larger and more complete coverage of producers in the 1954 canvass rather than to increased production. Data in 1954 were collected with the mandatory provisions of the Census of Minerals. Based on comparable coverage with 1953, sand and gravel tonnage is estimated to be 15 percent higher in 1954. About 37 percent of the sand was used as structural sand for making concrete and mortar and 56 percent for paving sand. Twenty-eight percent of the gravel output was used for making concrete, and 69 percent went into paving uses. The average value per ton increased from $1.14 to $1.22.

TABLE 16.—Sand and gravel sold or used by producers, 1950–54

Year	Commercial		Government-and-contractor		Total		
	Short tons	Value	Short tons	Value	Short tons	Value	
						Total	Average per ton
1950	5,245,714	$6,187,065	259,648	$123,360	5,505,362	$6,310,425	$1.15
1951	6,098,898	7,262,749	285,430	156,821	6,384,328	7,419,570	1.16
1952	5,788,098	6,660,994	217,021	75,530	6,005,119	6,736,524	1.12
1953	4,305,597	5,090,598	232,790	71,650	4,538,387	5,162,248	1.14
1954	7,641,229	9,592,566	268,923	94,069	7,910,152	9,686,635	1.22

Sulfur.—In 1954 sulfur production was the highest in United States history. Louisiana and Texas together produced all the Frasch sulfur in the United States. The tonnage of sulfur produced in the State was about four times greater than that produced in 1939, as

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compared with a threefold increase for the Nation in the same period. Sulfur recovered from the Freeport Sulphur Co. new mine (completed late in 1953) at Garden Island Bay at the mouth of the Mississippi supplied more than the 7-percent increase in total production for the United States. Shipments from Frasch mines in the State increased at a rate seven times that of the entire Nation. Louisiana shipments during 1954 were 1.9 million long tons, compared with 3.6 million tons from Texas. Wells for recovered sulfur by the Frasch process at Starks dome in Calcasieu Parish, Bay Ste. Elaine in Terrebonne Parish, and Garden Island and Grand Ecaille in Plaquemines Parish.

Progress in the expansion program of the sulfur industry continued as Freeport Sulphur Co. was completing its mine at Chacahoula dome. Offshore areas were opened by the Federal Government to exploration, and several discoveries were reported. Humble Oil & Refining Co. discovered sulfur 6 miles off the southern coast near Grand Isle. Although considerable drill testing was necessary to determine the size of the deposit, the company planned to drill 20 wells. Three were completed, and a fourth was underway.[15]

Small quantities of sulfur were also recovered from refinery sludges and from the liquid purification of natural gas.

TABLE 17.—Sulfur produced and shipped from Frasch mines, 1945–49 (average) and 1950–54

Year	Production	Shipments		
	Long tons	Long tons	Value	Average value per ton
1945–49 (average)	936,686	936,541	$16,003,281	$17.09
1950	1,243,020	1,256,026	23,700,000	18.87
1951	1,311,293	1,152,821	25,400,000	22.03
1952	1,508,550	1,449,668	32,015,000	22.08
1953	1,640,571	1,609,364	43,453,000	27.00
1954	2,009,553	1,853,563	49,222,394	26.56

METALS

Aluminum.—The $27 million 3-year expansion program neared completion at the Kaiser Aluminum & Chemical Corp. Baton Rouge alumina plant. The expansion will bring the company alumina productive capacity to 800,000 tons per year and was designed to meet requirements for its combined primary aluminum capacity of more than 400,000 tons annually at the Kaiser aluminum-reduction works at Chalmette, La., and Tacoma and Mead, Wash. The facilities provide for treating bauxite ore from the company newly developed deposits in Jamaica, British West Indies.[16]

The Chalmette plant of Kaiser Aluminum & Chemical Corp. in St. Bernard Parish remained the Nation's largest reduction works in 1954, with an annual ingot capacity of 200,000 tons.

[15] Mining World, vol. 16, No. 9, August 1954, p. 56.
[16] Engineering and Mining Journal, vol. 155, No. 12, December 1954, p. 132.

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REVIEW BY PARISHES [17]

Acadia.—Sizable quantities of petroleum, natural gas, and natural-gas liquids were again produced in Acadia Parish in 1954. Petroleum and natural-gas production declined a little during the year, compared with 1953. The parish remained the second largest producing parish in the State in the output of natural gas. Natural gasoline and liquefied petroleum gases were produced at the natural-gasoline plant at Egan operated by Acadia Corp. As a result of exploratory activity, the Northwest Maxie gas-condensate field was discovered in July 1954 by the Hassie Hunt Trust.

Assumption.—The Union Oil Co. of California discovered a new oil field named East Lake Palourde in April. Cities Service Producing Corp. discovered the Bay Natchez gas-condensate field at the end of October. Over $2 million of petroleum and a quarter million dollars of natural gas were produced during the year.

Avoyelles.—In order of the value of production, petroleum, natural-gas liquids, and natural gas were produced in Avoyelles Parish during 1954. Production of petroleum declined 20 percent in 1954, compared with 1953. Anchor Gasoline Corp. recovered cycle products and natural gasoline at its absorption plant at Eola.

Beauregard.—A. E. Moses Sand & Gravel Co. produced sand 20 miles west of DeRidder. Washed and screened sand and gravel was mined by C. A. Arnold Sand & Gravel Co. at its wet pit at Merryville. There were 2 plants producing natural gasoline and other liquefied-petroleum-gas products in Beauregard Parish, 1 at Merryville using the absorption process and 1 at Longville using the compression process. Magnolia Petroleum Co. discovered the Fayette Spur gas-condensate field, and Texas Gulf Producing Co. discovered the Ragley gas-condensate field during 1954. Crude-petroleum and natural-gas production declined.

Bienville.—Building brick and face brick were manufactured by the Norman Brick Co. from clay produced at a pit near the plant at Ringgold. Natural gas, natural-gas liquids, and petroleum were also produced in Bienville Parish. Arkansas-Louisiana Gas Co. recovered natural gasoline and other cycle products from natural gas at its Ringgold plant. The Placid Oil Co. discovered a new gas field, called the Liberty Hill in Bienville Parish in 1954. On October 4 Pure Oil Co. discovered the Cypress Springs oilfield.

Bossier.—In August Southwestern Perlite, Inc., acquired the expanded-perlite plant at Bossier City from R. S. Allday Clay Products Co. The lightweight product was made from crude perlite purchased from Colorado and New Mexico. Paying gravel for public construction work was produced by the Bossier Parish Police Jury. Natural gasoline and cycle products were produced at 2 plants at Haughton and 1 at Benton. Crude-petroleum production declined 24 percent during the year. Bossier Parish was the third largest producer of natural gas in the State during 1954, with an output of over 84 billion cubic feet of gas. In March Lion Oil Co. discovered the Cottage Grove oilfield in Bossier Parish.

[17] Parish data for petroleum and natural gas are based on information from the Department of Conservation of the State of Louisiana, Annual Oil and Gas Report, 1954.

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TABLE 18.—Value of mineral production in Louisiana by parishes, 1953–54[1]

Parish	1953	1954	Minerals produced in 1954, in order of value
Acadia	$42,242,727	$37,326,551	Petroleum, natural gas, natural-gas liquids.
Allen	2,107,669	2,593,447	Do.
Ascension	622,000	622,280	Petroleum, natural gas.
Assumption	1,701,000	2,263,720	Do.
Avoyelles	4,732,677	4,328,228	Petroleum, natural-gas liquids, natural gas.
Beauregard	10,627,184	10,772,918	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Bienville	3,630,200	3,650,667	Natural gas, natural-gas liquids, petroleum, clay.
Bossier	22.067,945	18,108,923	Natural gas, petroleum, natural-gas liquids, sand and gravel.
Caddo	22,661,313	42,779,245	Petroleum, natural-gas liquids, natural gas, sand and gravel, clay.
Calcasieu	40,698,906	38,228,011	Petroleum, natural gas, sulfur, lime, salt, natural-gas liquids, clay.
Caldwell	307,000	317,307	Natural gas, petroleum.
Cameron	28,602,000	31,202,930	Petroleum, natural gas, oystershell.
Catahoula	2,585,470	2,329,490	Petroleum, natural gas, sand and gravel.
Claiborne	29,869,642	25,992,979	Petroleum, natural gas, natural-gas liquids.
Concordia	12,527,000	14,911,321	Petroleum, natural-gas liquids, natural gas.
De Soto	5,040,000	3,831,385	Natural gas, petroleum.
East Baton Rouge	10,636,453	12,770,931	Petroleum, cement, sand and gravel, natural gas, sulfur, clays.
East Carroll	5,000	(2)	Sand and gravel, natural gas.
East Feliciana	(2)	(2)	Sand and gravel.
Evangeline	13,069,422	13,722,988	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Franklin	2,648,000	1,912,773	Petroleum, natural gas.
Grant	112,000	273,412	Sand and gravel, petroleum, natural gas.
Iberia	54,749,389	53,019,685	Petroleum, salt, natural gas, sand and gravel.
Iberville	19,292,053	19,144,102	Petroleum, salt, natural gas.
Jackson	98,000	56,869	Natural gas.
Jefferson	28,792,324	28,291,668	Petroleum, natural gas, natural-gas liquids.
Jefferson Davis	14,484,944	16,297,514	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Lafayette	231,458	389,110	Petroleum, natural gas, clays.
Lafourche	73,646,000	80,810,887	Petroleum, natural gas.
La Salle	17,699,000	18,215,533	Petroleum, natural gas, sand and gravel.
Lincoln	18,876,369	13,346,130	Natural-gas liquids, natural gas, petroleum, clays.
Livingston	539,000	449,745	Petroleum, natural gas.
Madison	1,645,000	1,423,191	Do.
Morehouse	1,805,000	1,531,492	Natural gas, sand and gravel, petroleum.
Natchitoches	392,000	379,175	Petroleum, natural gas, clays.
Orleans	5,208,202	5,927,438	Cement, clays, petroleum, sand and gravel, natural gas.
Ouachita	2,521,758	2,714,498	Natural gas, sand and gravel, clays, petroleum.
Plaquemines	142,416,952	178,147,836	Petroleum, sulfur, natural gas.
Pointe Coupee	7,955,023	8,298,309	Petroleum, natural gas, clays.
Rapides	3,405,263	2,788,887	Petroleum, sand and gravel, natural-gas liquid, natural gas, clay.
Red River	768,000	675,253	Petroleum, natural gas.
Richland	17,040,735	15,061,288	Petroleum, natural-gas liquids, natural gas.
Sabine	321,000	316,039	Petroleum.
St. Bernard	3,000	124,320	Petroleum, natural gas.
St. Charles	24,052,723	24,429,741	Petroleum, natural-gas liquids, natural gas.
St. James	5,217,000	4,899,955	Petroleum, natural gas.
St. John the Baptist	262,000	288,274	Natural gas, petroleum.
St. Landry	19,028,965	18,206,963	Petroleum, natural gas, natural-gas liquids.
St. Martin	32,244,592	35,372,650	Petroleum, natural gas, salt, natural-gas liquids.
St. Mary	43,471,175	46,571,126	Petroleum, natural gas, natural-gas liquids.
St. Tammany	519,985	809,016	Sand and gravel, natural gas, petroleum, clay.
Tangipahoa	66,794	597,166	Sand and gravel, clays.
Tensas	6,687,000	5,945,549	Petroleum, natural gas.
Terrebonne	72,570,663	72,142,257	Petroleum, natural gas, sulfur.
Union	8,058,000	8,282,649	Natural gas, natural-gas liquids, petroleum.
Vermilion	39,435,641	33,034,975	Petroleum, natural-gas liquids, natural gas.
Washington	821,485	1,100,306	Sand and gravel, natural gas, petroleum.
Webster	32,222,982	24,512,861	Petroleum, natural-gas liquids, natural gas, sand and gravel.
West Baton Rouge	1,408,279	1,402,357	Petroleum, natural gas.
West Carroll	97,000	120,964	Natural gas.
West Feliciana	(2)	(2)	Sand and gravel.
Winn	1,456,462	1,659,370	Salt, petroleum, gypsum, natural gas.
Undistributed	9,232,173	2,504,762	
Total	965,237,000	[3]996,978,000	

[1] St. Helena and Vernon Parishes are not listed because no production was reported.
[2] Value included with "Undistributed."
[3] Total has been adjusted to eliminate duplication in clays and stone.

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Caddo.—Caddo Parish was the largest producer of natural-gas liquids in the State during 1954. Eight plants in the parish recovered natural gasoline and cycle products from natural gas plants at Shreveport, Rodessa, Gilliam, Myrtis, Trees, and Ida. Petroleum production increased 24 percent, and the output of natural gas in the parish increased 14 percent in 1954, compared with 1953. Sand was dredged from the bank of the Red River near Shreveport by Meriwether Sand Co. and used for construction and other purposes in that area. Brick were manufactured by Arklatex Face Brick Co. from local clay at the Mooringsport plant.

Calcasieu.—At Lake Charles lime is made from oystershell from coastal reefs by the rotary kiln method by Olin Mathieson Chemical Corp. The quicklime is used by the company in its operating chemical plant. Sulfur was produced by the contact method by Cities Service Refining Co., both in the form of sludge sulfur from the refining operation and as hydrogen sulfide from liquid purification of gas. Salt brines were produced from wells into salt domes in the parish by Olin Mathieson Chemical Co. and Columbia-Southern Chemical Corp. for use in their chemical plants. The parish was the third largest in the State in production of salt. Clay was mined from a pit at Lake Charles by Price Dunham Fenet Brick Co. for the manufacture of heavy clay products. Frasch sulfur was produced from wells in the Stark dome by Freeport Sulphur Co. 6 miles south of Starks, La. Calcasieu Parish was the third largest producer of Frasch sulfur in the State. Production of natural gas and petroleum declined in 1954. Natural gasoline and cycle products were recovered from natural gas at plants at Lake Charles and Iowa using the absorption process. A gas-condensate field was discovered by W. T. Burton in Calcasieu Parish in November 1954 and was designated the Pine Ridge field.

Cameron.—Production of crude petroleum remained at about the same level as 1953. Natural-gas production increased 15 percent. Natural-gas production in Cameron Parish was the fourth highest in the State. The South Grand Cheniere and the Crab Lake gas-condensate fields were discovered in Cameron Parish in 1954. As a result of offshore drilling on the leases in the Gulf of Mexico off Cameron Parish, an oilfield was discovered in block 110 of the West Cameron area and a gas-condensate field was located in block 192, West Cameron area. In the East Cameron Area, Continental Oil Co. discovered a gas-condensate field in block 71 in October.

Catahoula.—In order of the value of production, petroleum, natural gas, and sand and gravel were produced in Catahoula Parish. There were declines both in the production of natural gas and petroleum. The quantity of natural gas recovered from the wells of Catahoula Parish was 27 percent lower in 1954 than in 1953. Petroleum output dropped 16 percent. W. R. Slay Construction Co. produced washed gravel at its pit and washing plant 4½ miles northeast of Sicily Island. At Manifest, La., sand and gravel was produced and processed by Glen Drewett.

Claiborne.—Petroleum, natural gas, and natural-gas liquids were produced in Claiborne Parish in 1954. The output of six natural-gasoline and cycle plants in Claiborne Parish ranked the fifth highest among parishes producing natural-gas liquids in Louisiana. Pro-

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duction of crude petroleum declined 12 percent in 1954 and natural gas 20 percent.

Concordia.—The natural gas and crude-oil wells of Concordia produced slightly less than the quantity produced in 1953. Natural gasoline and cycle products were recovered from natural gas at the California Co. cycling plant at Lake St. John. Exploratory activity in Concordia Parish led to discovery of the Black Hawk, the Waverly Point, and the Milestone Forks oilfields in 1954. There was a rediscovery in the Clayton field by W. L. Billups-Gauthier & Heard.

De Soto.—A new gas-condensate field was discovered by Natural Gas & Oil Co. in De Soto Parish in 1954. The field will be called the Belle Bower. Production of crude petroleum and natural gas declined somewhat during the year.

East Baton Rouge.—Cement was manufactured from oystershell at Baton Rouge by the Ideal Cement Co.; the plant operated four rotary kilns in 1954. Expansion plans call for the construction of additional cement silos for storage at this plant. Consolidated Chemical Industries, Inc., produced brimstone as a byproduct of the liquid purification of gas by the Claus process at its Baton Rouge plant. Clay for manufacturing brick was produced by Acme Brick at Baton Rouge. Sand and gravel was dredged from river banks and beds by four operators in East Baton Rouge Parish for building and road construction at nearby Baton Rouge. Two of these plants were of the portable type that can be moved to new sites as needed for new deposits or changing market conditions. Petroleum and natural-gas production declined during the year.

East Carroll.—River sand and gravel was dredged and processed at a portable preparation plant by the Delta Dredging Co. of Greenville for use in road construction. A small volume of natural gas was produced.

East Feliciana.—In 1954, East Feliciana Parish was the largest producing parish of sand and gravel tonnage in Louisiana. In the western part of the parish at Jackson, sand and gravel was dredged hydraulically and washed, screened, and classified for various construction and road-building uses by the Holloway Gravel Co. At Bluff Creek in the eastern part of the parish, sand and gravel was produced in a wet pit and screened and washed in the processing plant of the Flint Sand & Gravel Co., Inc.

Evangeline.—The value of sand and gravel produced in Evangeline Parish ranked fourth highest in the State in 1954. Other mineral production included crude petroleum, natural gas, and natural-gas liquids. The production of crude petroleum and natural gas in 1954 was about the same as in 1953.

Grant.—Sand and gravel and small quantities of crude oil and natural gas were produced in Grant Parish in 1954. On November 26 Clay Oil & Gas Corp. discovered the Mill Creek oilfield; this may lead to increased production in the parish in the future. Building and road sand and gravel was dredged, washed, screened, and classified by the Witte Gravel Co. at Colfax. The same company operated a wet pit near Pollock.

Iberia.—The value of mineral production in Iberia Parish ranked fourth highest in the State in 1954. In order of value, crude petro-

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leum, salt, natural gas, and sand and gravel were produced. Iberia ranked fourth in the production of petroleum and first in production of salt. Evaporated salt, rock salt, and pressed-salt blocks were produced at the underground mine and refinery operated by the International Salt Co., Inc., near Avery Island, La. Evaporated salt is produced by the vacuum-pan method. Similar operations were carried on by the Morton Salt Co. at Weeks Island and by Jefferson Island Salt Co., Inc., at New Iberia. Iberia Sand & Gravel Co. at New Iberia dredged sand from a nearby lake and washed and screened the material for use in paving and road building.

Iberville.—The Solvay Process Division of Allied Chemical & Dye Corp. produced salt brines primarily for its own use from wells near Baton Rouge. Production of petroleum in the parish declined a little during the year, but natural-gas production was higher. An exploratory well in Iberville Parish led to discovery of the Bayou Sorrel gas-condensate field on September 19, 1954.

Jefferson Davis.—Sand and gravel was dredged at Indian Village by Witte Gravel Co. for building and highway uses. Petroelum production declined during the year compared with 1953, but natural-gas production increased. Natural gasoline and other natural-gas liquids were produced at plants at Jennings and South Jennings. On August 27, 1954, the Ada Oil Co. discovered the North Edna oil field in Jefferson Davis Parish.

Lafayette.—Petroleum, natural gas, and clay were produced during 1954. The Mike Baker Brick Co. produced clay for its brick plant at Lafayette. The Scott oilfield was discovered in February by Bates & Cornell in Lafayette Parish.

Lafourche.—Freeport Sulphur was completing work at Chacahoula mound near Thibodaux for production of sulfur by the Frasch method. Lafourche Parish ranked second in the State in the production of crude petroleum and was a leading parish in the production of natural gas. The gas-condensate field discovered by Paul F. Barnhardt was designated the Thibodaux field. In September the North Thibodaux gas-condensate field was located by J. R. Frankel.

La Salle.—Quality Sand & Gravel Co. produced, washed, and screened sand at its pit and preparation plant 10 miles northeast of Vena, La. Production of both natural gas and petroleum declined in La Salle Parish during 1954, compared with 1953. The Little Bayou gas field was discovered by Nebo Oil Co. in July.

Lincoln.—Building and face brick were manufactured by Ruston Brick Works from clays produced from its pit near Ruston. Bentonite was mined in Lincoln Parish by the Filtrol Corp. Petroleum, natural gas, and natural-gas liquids were also produced during the year. The parish ranks fourth in the State in the production of natural-gas liquids. On May 10, 1954, the Terryville gas-condensate field was discovered.

Morehouse.—Petroleum, natural gas, and sand and gravel were produced in Morehouse Parish during 1954. At Bastrop the Bastrop Sand & Gravel Co. pumped sand and gravel from the bayou. Crude-petroleum and natural-gas production was a little lower than in 1953.

Natchitoches.—Clays for manufacturing brick were produced by the Natchitoches Brick Plant. A small quantity of natural gas was pro-

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duced in association with crude-petroleum production from wells in Natchitoches Parish.

Orleans.—Portland cements were produced at the New Orleans plant of Lone Star Cement Corp. to supply material for building and industrial construction to the State's largest metropolitan area. Limestone was the raw material used as feed for the plant's four rotary kilns. Expanded perlite was manufactured by Alatex Construction Service, Inc., at its plant at New Orleans from crude perlite from Western States. Also at New Orleans, artificially colored roofing granules were produced by the Flintkote Co. Vermiculite was exfoliated by the Zonolite Co. at its Bergundy plant near New Orleans, using crude vermiculite imported from other States. Barite was crushed and ground by Magnet Cove Barium Corp. at its mill and grinding plant at New Orleans for well drilling and other uses. Sand was produced in Orleans Parish by The Jahncke Service Co., Inc.

Ouachita.—Heavy clay products were manufactured by the Acme Brick Co. near Monroe from local clays. Two sand and gravel operations at Monroe produce and prepare sand and gravel—Monroe Sand & Gravel Co., Inc., and Twin City Gravel Co. The value total of sand and gravel produced in Ouachita Parish was the third highest in the State. Natural-gas production declined in 1954. A small quantity of condensate was produced from wells in the parish. Carter Oil Co. discovered the Bridge Grake gas field in August 1954.

Plaquemines.—Most large Frasch-sulfur production in Louisiana came from wells in Plaquemines Parish. The beginning of operations at Freeport Sulphur Co. new mine at Garden Island Bay makes this area one of the Nation's most important sulfur-producing regions. Another of Freeport's sulfur-producing operations at Grand Ecaille continued pumping large quantities of sulfur from below the ground. Plaquemines had the largest production in the State in 1954. The production of crude petroleum and natural gas was higher in 1954 than in 1953. The oilfield discovered by The California Co. in Plaquemines Parish on April 26, 1954, was designated the Dixon Bay field. As a result of offshore drilling activity, a gas-condensate field was discovered in block 52 of the West Delta area and oilfields were discovered in block 23 of the Main Pass area and in block 27 of the South Pass area.

Pointe Coupee.—Big River Industry, Inc., purchased the McDearman Lightweight Aggregate Co. plant at Erwinville in October 1954. Pointe Coupee was the leading parish in terms of production of shale. Petroleum production declined a little during the year, but natural-gas output increased.

Rapides.—On October 18, 1954, Acme Brick Co. took over operations of the Tri-State Brick & Tile Co. plant at Alexandria. Heavy clay products were manufactured from clay produced locally. Sand and gravel was produced in five localities in Rapides Parish in 1954. At Alexandria, Rapides Gravel Co., Inc., marketed a washed and screened product. H. W. Holeman obtained road gravel from a dry pit near Forest Hill. Sand and gravel for building and roadwork was dredged from a wet pit near Paradis by Central Sand & Gravel Co., Inc. Material for paving and road construction was dredged, washed, and screened at the Alexandria Gravel Co. plant

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site at Woodworth. S. M. Stewart produced sand and gravel from a dry pit near Boyce, La. Petroleum, natural gas, and natural-gas liquids were also produced. Natural-gas liquids were produced at Cheneyville at a plant using the absorption process.

Richland.—In order of value of production, petroleum, natural-gas liquids, and natural gas were produced in 1954. Seventeen percent less crude petroleum and 26 percent less natural gas were produced from wells in Richland Parish, compared with 1953. Natural gasoline and other natural-gas liquids were produced at Sun Oil Co. plant in Delhi.

St. Bernard.—On June 3 the Texas Co. discovered an oilfield in St. Bernard Parish, designated the Lake Anthanasie. As a result of offshore exploratory activity in the Chandeleur Sound area in the Gulf of Mexico off St. Bernard Parish, Phillips Petroleum Co. discovered an oilfield in block 41, and the Texas Co. discovered a gas field in block 69.

St. Charles.—Petroleum, natural-gas liquids, and natural gas were produced in St. Charles Parish during 1954. Natural gasoline and other natural-gas liquids were produced at the Paradis plant of the Texas Co. Petroleum production declined about 13 percent, but natural-gas production rose a little above that in 1953. The St. Rose oilfield was discovered by the California Co. on January 6, 1954.

St. Landry.—Natural gasoline and other natural-gas liquids were produced at the Opelousas plant of the Humble Oil & Refining Co. Petroleum and natural-gas production declined slightly in 1954 from 1953.

St. Martin.—Evaporated salt and pressed blocks of evaporated salt were produced at Breau Bridge at the wells and mill of Gordy Salt Co., Inc. Production of salt in St. Martin Parish was the fifth highest in the State. Petroleum, natural gas, and natural-gas liquids were also produced. There was one natural-gasoline plant near Breau Bridge. Humble Oil & Refining Co. discovered a gas-condensate field in October that was designated the American Island. In November the same company discovered the North American Island field.

St. Mary.—The value of crude petroleum and natural gas produced in St. Mary Parish was the fifth highest in the State. Although the value of crude-petroleum production declined 4 percent, that of natural gas increased nearly 34 percent in 1954, compared with 1953. In block 18 of the Eugene Island area offshore from St. Mary Parish, Shell Oil Co. discovered a new oilfield in June.

St. Tammany.—Two brick companies—St. Joe Brick Works, Inc., and Schneider Brick & Tile Co.—manufacture structural clay products from clays mined at pits near Slidell, La. Grinding and polishing sand was produced near Sun in the northeastern part of the parish at the dry pit and preparation plant of Mississippi Valley Silica Co., Inc. A second plant at Sun belonging to Valley Sand & Gravel Co., Inc., prepares gravel and ground sand from a wet pit. Kivett & Reel, Inc., produces washed and screened sand and gravel from a lake near Sun for paving and road construction. At Bush St. Tammany Sand & Gravel Co. marketed a washed sand and gravel. Sand and gravel for building uses was dredged in the parish by Washington Sand &

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Gravel Co. Small quantities of petroleum and natural gas were also produced.

Tangipahoa.—Clay mined at Baptist was used by the Hammond Baton Rouge Brick Co. for the manufacture of building and face brick. At Amite Anderson Gravel Co. dredged sand and gravel from the river for screening, washing, and classifying for use in road building and paving. Rogers Bros. Sand & Gravel Co. dredged gravel from the river near Tickfaw. Kinchen Gravel Co. at Hammond, Independence Sand & Gravel Co. at Independence, Charles Black Sand & Gravel Co. and Watson Sand & Gravel Co., both at Fluker, produced washed sand and gravel. A portable preparation plant of Gulf Sand & Gravel Corp. processed sand and gravel for building uses from a wet pit at Amite.

Tensas.—The value of crude petroleum and natural gas produced from wells in Tensas Parish was lower in 1954 than in 1953. The St. Joseph oilfield was discovered in 1954 by Interstate Natural Gas Co. The Locust Ridge gas field was discovered by R. L. Rowley.

Terrebonne.—Terrebonne Parish ranked first in the State in the value of production of natural gas and third in crude petroleum. The quantity of petroleum produced during 1954 was about the same as in 1953. Natural-gas production, however, increased 5 percent. On February 23, 1954, the Crescent Farms gas-condensate field was discovered by Arkansas Fuel Co. and John W. Mecom. In May another gas-condensate field, designated the Southeast Houma, was discovered by Warren Petroleum Corp. Frasch sulfur was produced from wells at Bay St. Elaine by Freeport Sulphur Co. Terrebonne Parish was the second largest producer of Frasch sulfur in the State.

Union.—W. C. Feazel discovered the Bernice oilfield on March 14, 1954, in Union Parish. In order of value of production the mineral products of this parish were natural gas, natural-gas liquids, and crude petroleum. Crude-oil and natural-gas production declined again in 1954. The Hunt Oil Co. plant at Bernice produced natural gasoline and other cycle products.

Vermilion.—Oil and gas exploration led to discovery of four new fields in Vermilion Parish in 1954. Two fields—the Leleux and the North Pecan Island—contained gas and condensate. The Live Oak Field was an oilfield and the Southeast Gueydan Field a gas field. Crude oil, natural-gas liquids, and natural gas were produced during the year. The second largest producing plant of natural-gas liquids in the State is operated by The Texas Co. near Erath. The parish also ranked second in the State in the production of these mineral products of natural gas.

Washington.—Standard Gravel Co. portable preparation plant crushed, washed, and screened sand and gravel for road building and paving at the company pit at Franklinton. Also producing at Franklinton is Burkhalter Sand & Gravel, with a dredge working a wet pit. Sand and gravel for paving and road uses was produced by Willis Sand & Gravel Co., Inc., 4½ miles south of Franklinton. Lakeview Sand & Gravel Co., produced sand and gravel for building and paving purposes and ground sand for filler at its dredging operation and preparation plant near Bogalusa. Washington Sand & Gravel dredged, washed, and screened sand and gravel for building purposes

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in Washington Parish. Crude petroleum and natural gas also were produced.

Webster.—Five companies produced sand and gravel in Webster Parish in 1954; three—Braswell Sand & Gravel Co., Inc., Gifford-Hill & Co., Inc., and Winford Sand & Gravel—produce near Minden. The value of their production of sand and gravel was larger than the output of any other parish in the State. Minden Material Co. dredged from a wet pit and screened and washed the material at its preparation plant on the Ogden Spur 1 mile north of Heflin. Gravel for road construction was produced near Sibley by Ford & Sistrunk Sand & Gravel Co. The quantity of both natural gas and petroleum produced was about 5 percent higher than in 1953. Webster Parish ranked third in the State in the production of natural-gas liquids. The plant at Cotton Valley belonging to the Cotton Valley Operators Committee is the largest producer of natural-gas liquids in Louisiana. On July 7, 1954 the Red Rock oilfield was discovered in Webster Parish.

West Feliciana.—Sand and gravel for road construction was produced near Jackson in the eastern part of the parish by Feliciana Sand & Gravel Co. Holloway Gravel Co. operated a hydraulic dredge and a preparation plant for washing, screening, and classifying sand and gravel for various uses near Jackson. Jackson Sand & Gravel Co., Inc., produced and washed sand and gravel from a riverbed.

Winn.—Salt, petroleum, gypsum, and natural gas were produced in Winn Parish in 1954. The parish ranks fourth in the State in the quantity of salt produced during the year. Rock salt and pressed-salt blocks were mined and prepared by the Carey Salt Co. from an underground mine in a salt dome at Winnfield. Anderson-Dunham Co. quarried gypsum at its quarry near Winnfield for use as road-building aggregate and as a retarding agent in cement. Production of crude oil from wells in the parish was higher than in 1953, but natural-gas production was lower. The Crossroads oilfield was discovered in Winn Parish in July 1954.

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The Mineral Industry of Maine

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, United States Department of the Interior, and the Geological Survey of Maine.

By Alvin Kaufman[1] and C. Geraldine Cleary[2]

THE VALUE of Maine mineral production exceeded the $10 million mark for the second consecutive year in 1954 as dollar output increased $153,000 over 1953. Some production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage. The greater mineral production value was due, in large measure, to higher stone output accompanied by increased total value. Value of production for feldspar, cement, peat, lime, and mica also increased. The major dollar declines were in the sand and gravel and slate industries.

Cement, sand and gravel, and stone, which furnished 92 percent of Maine's mineral value, were the major commodities. The leading producing counties, in order of value, were Knox and Kennebec. The mines and quarries of these 2 counties were responsible for 76 percent of Maine's total mineral value.

TABLE 1.—Mineral production in Maine, 1953–54[1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement—376-lb. barrels	2,001,464	$5,422,272	1,973,249	$5,425,184
Clays	29,661	27,476	26,872	26,872
Feldspar (crude)—long tons	17,637	117,090	(3)	(3)
Peat	2,428	73,564	2,350	99,831
Sand and gravel	8,071,937	2,608,386	7,460,620	2,538,143
Stone	[2] 248,501	[2] 1,215,439	1,023,709	2,355,385
Undistributed: Beryllium concentrate, columbium-tantalum concentrate, gem stones, lime, mica, quartz from pegmatites or quartzite (1953), slate, stone (crushed limestone 1953), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2)	----------	1,038,883	----------	801,140
Total Maine	----------	10,503,000	----------	[4] 10,716,000

[1] Production as measured by mine shipments, sales or marketable production (including consumption by producers).
[2] Value included with "Undistributed."
[3] Excludes certain stone, value for which is included with "Undistributed."
[4] Total has been adjusted to eliminate duplication in value of clays and stone.

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There was considerable mineral exploratory activity in Maine in 1954. Kennecott Copper Co. carried on a geological and geophysical program in the State during the year, and several other companies engaged in reconnaissance work. The Federal Geological Survey continued its areal magnetic and scintillometer survey of an 800-square-mile area along the New Brunswick border and completed a wider areal reconnaissance by car and airborne scintillometer.

REVIEW BY MINERAL COMMODITIES

METALS

Beryllium.—The Scotty mine of Beryllium Development Co., Inc., near Bethel, Oxford County, continued to be the largest of Maine's four beryl producers. Most of the State's production was trucked to the Materials Purchase Depot at Franklin, N. H., for sale under the provisions of the GSA beryl-purchase program.

Columbium-tantalum.—A small quantity of columbium-tantalum concentrate was produced in Sagadahoc County by Cesare Trusiani from the Powers mine near Topsham. All of this material was sold to the General Services Administration (GSA) at Franklin, N. H.

Manganese.—The Bureau of Mines continued its investigation of recovery methods for the low-grade manganese ores of Aroostook County. The chemical techniques applied to ores from three areas in the county indicated that these differ in amenability to chemical attack, and a process must be tailored to the characteristics of the particular ore.[3]

NONMETALS

Cement.—Cement continued to be Maine's most important mineral in 1954 in terms of value. Output, as in previous years, composed over 50 percent of the State's total mineral value. The only producer was the Dragon Cement Co., Inc., operator of a 2-million-barrel-per-year wet-process plant at Thomaston, Knox County. Production consisted of general-use and moderate-heat, as well as high-early strength, cements.

Clays.—Tonnage of clays produced in Maine in 1954 declined 9 percent compared with 1953. Output consisted of miscellaneous

TABLE 2.—Clays sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value	
		Total	Average per ton
1945–49 (average)	20,740	$17,424	$0.84
1950	31,917	26,561	.83
1951	21,885	21,885	1.00
1952	26,050	26,050	1.00
1953	29,661	27,476	.93
1954	26,872	26,872	1.00

[3] MacMillan, R. T., Turner, T. L. Recovery of Manganese From Ores of Aroostook County, Maine: Bureau of Mines Rept. of Investigations 5082, 1954, 41 pp.

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clays for heavy clay products, principally building brick. Production was obtained from 2 surface mines in Androscoggin County, 4 in Cumberland County, and 1 in Penobscot County. Androscoggin County was the major producing area; Cumberland ranked second. Morin Brick Co., Androscoggin County, and La Chance Bros. Brick Co., Cumberland County, were the largest producers.

Feldspar.—Production of feldspar declined 3 percent in 1954 compared with the previous year. The average value per ton rose from $6.64 in 1953 to $7.35 in 1954. There were 15 mines active—2 in Androscoggin County, 5 in Oxford County, and 8 in Sagadahoc County. The largest producing mines were the Bell Minerals Co. operations in Androscoggin and Oxford Counties, followed by the Topsham mine of Consolidated Feldspar Dept., International Minerals & Chemical Corp., in Sagadahoc County. Virtually all of the State's crude feldspar was prepared in three grinding mills. The Bell Minerals Co. mill at West Paris, Oxford County, treated company ore only. The Topsham plant of Consolidated Feldspar Dept., International Minerals & Chemical Corp., and the Topsham Feldspar Co. mill (Topsham) ground company-mined as well as purchased ore. The bulk of the ground-feldspar output was utilized in pottery, porcelain, tile, soap, and abrasives manufacture.

Lime.—Quicklime for chemical purposes and hydrated lime for agricultural use were produced by Rockland-Rockport Lime Co., Inc., at its Rockland plant in Knox County in 1954. This was the only producing lime plant in Maine.

Mica.—Value of production of sheet mica increased substantially in 1954, primarily as a result of the Federal mica purchasing program. Sales to the GSA Materials Purchase Depot, Franklin, N. H., increased from 2,189 pounds of sheet mica in 1953 to 3,923 pounds in 1954.[4] Over 30 operators produced from 17 different mines in Oxford County, some of whom mined from the same mine. The largest producer was the Roger W. Wheeler mine near Gilead, Oxford County. Most of the output of this mine was scrap mica.

Sand and Gravel.—Output of sand and gravel for commercial purposes rose 34 percent in 1954, and production by Government-and-contractor operations declined 12 percent. Inasmuch as the latter comprised 86 percent of total sand and gravel produced, production from all sources dropped 8 percent. Most (98 percent) of the sand and gravel was sold for structural and paving purposes. The largest producer in the State was the Maine State Highway Commission, Augusta. Kennebec, Androscoggin, Cumberland, and Aroostook Counties were the principal producing areas.

Slate.—Portland-Monson Slate Co. continued to produce electrical, roofing, and flagging slate at its Monson plant in Piscataquis County in 1954. This company was one of the principal domestic sources of switchboard panels and miscellaneous electrical slates.

Stone.—Production of stone remained the third largest mineral industry in the State in 1954. Twelve quarries were active during the year; 3 of these were in limestone, 3 in sandstone, and 6 in granite. Dimension, as well as crushed and broken stone, was produced during the year. The crushed and broken stone was utilized for riprap,

[4] Converted to full-trim basis.

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TABLE 3.—Sand and gravel sold or used by producers, 1953–54, by classes of operations and uses

	1953		1954	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Structural	41,490	$21,512	144,766	$121,261
Paving	47,737	58,215	71,268	48,913
Railroad ballast	31	23		
Gravel:				
Structural	99,046	70,907	254,380	196,032
Paving	477,577	278,809	415,033	287,623
Railroad ballast	97,376	52,328	(1)	(1)
Other	8,468	4,308	62,615	15,794
Undistributed [2]	6,840	9,142	93,097	24,671
Total commercial sand and gravel	778,565	495,244	1,041,159	694,294
GOVERNMENT-AND-CONTRACTOR OPERATIONS				
Sand:				
Structural	68	250	16,200	520
Paving	300,219	95,080	238,380	72,609
Gravel:				
Structural	7,755	1,264	4,050	180
Paving	6,985,330	2,016,548	6,160,831	1,770.540
Total Government-and-contractor sand and gravel	7,293,372	2,113,142	6,419,461	1,843,849
Grand total	8,071,937	2,608,386	7,460,620	2,538,143

[1] Figures that may not be shown separately are listed as "Undistributed."
[2] Includes engine, filter, other sand and gravel indicated by footnote 1.

concrete aggregate, and road material. The largest producing counties, in order of value, were Hancock, Knox, and Cumberland.

MINERAL FUELS

Peat.—The principal producing peat bogs in Maine were in Washington and Hancock Counties in 1954. Output during the year was marketed locally for agricultural purposes.

REVIEW BY COUNTIES

Androscoggin.—The mines and quarries of Androscoggin County produced sand and gravel, feldspar, and clays in 1954. The County ranked first in the State in value of clays and feldspar, second in sand-and-gravel dollar output, and fifth in total value of mineral output. Sand and gravel was produced at 15 pits in the county for structural, paving, engine, and miscellaneous uses. Commercial producers were: W. E. Cloutier Co., Inc., Lewiston; R. F. Dobbins, Webster; Philip E. Dunn, Poland; W. H. Hinman, Inc., Leeds; Kramarz & Dingley, Lisbon Falls; Alice Knox, Livermore Falls; Lewiston Crushed Stone Co., Inc., Lisbon; C. W. Meserve & Sons, Mechanic Falls; Geo. Moore, Lisbon; and G. A. Peterson Co., Auburn.

Feldspar was produced by the Bell Minerals Co. at the La Flamme and Sturtevant surface mines near Center Minot. Joseph F. Dennis & Sons, Auburn, and Morin Brick Co., Danville, produced miscellaneous clays for the manufacture of building brick.

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TABLE 4.—Value of mineral production in Maine, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value
Androscoggin	$332,911	$374,545	Sand and gravel, feldspar, clays, gem stones.
Aroostook	(2)	81,893	Sand and gravel.
Cumberland	296,978	447,354	Stone, sand and gravel, clays.
Franklin	8,937	17,046	Sand and gravel.
Hancock	519,935	(2)	Stone, peat, sand and gravel.
Kennebec	2,280,776	2,069,983	Sand and gravel, stone.
Knox	5,987,004	5,980,241	Cement, stone, lime.
Oxford	118,489	110,678	Mica, beryl, feldspar, sand and gravel, gem stones.
Penobscot	68,697	229,676	Sand and gravel, stone, clays.
Piscataquis	(2)	(2)	Slate.
Sagadahoc	48,078	(2)	Feldspar, sand and gravel, columbium-tantalum concentrate.
Somerset	(2)	(2)	Sand and gravel.
Waldo	(2)	(2)	Sand and gravel, stone.
Washington	81,164	(2)	Peat, sand and gravel.
York	(2)	(2)	Stone, sand and gravel.
Undistributed	760,140	1,404,532	
Total	10,503,000	10,716,000	

[1] Lincoln county not listed because no production was reported.
[2] Included with "Undistributed."

Aroostook.—Sand and gravel for structural, paving, railroad ballast, and miscellaneous purposes was produced in Aroostook County in 1954 by Bull Bros., Washburn; Lawrence Burleigh, Houlton; Quint Bros., Hodgdon Mills; and the Bangor & Aroostook Railroad.

Cumberland.—Cumberland County ranked fourth in value among the mineral-producing counties of Maine in 1954. Stone, sand and gravel, and clays were yielded by the mines and quarries of the county. Quartzite for riprap, concrete aggregate, and road material was produced by Blue Rock Quarry, Cumberland Mills. Cesare Trusiani, Brunswick, extracted quartz from various waste piles in the area. This material was crushed and sold for abrasives manufacture. Sand and gravel for structural and paving purposes was produced by Cumberland Sand & Gravel Co., Cumberland Center; Hartley Gravel Co., Brunswick; Fred H. Jordan, South Portland; G. H. Morton, Brunswick; and Charles W. Qualey, Gray.

Heavy clay products were produced from local clays by Joseph A. Blais, Jr., Cumberland Center; La Chance Bros. Brick Co., Gorham; Fred S. Liberty & Son, Cumberland; and Royal River Brick Co., North Yarmouth.

Franklin.—The only mineral commodity produced in Franklin County in 1954 was sand and gravel. Active producers were E. N. Barry, Farmington; Omar Beisaw, Jay; Thomas A. Skolfield, Weld; and Donald Ames, Sharon. The O. C. Marchant sand pit near Weld was abandoned during the year. There was no reported production of clays in the county in 1954. In previous years output had been reported from an open pit near Farmington.

Hancock.—Dimension granite for architectural uses was quarried by Deer Island Granite Corp. from its Deer Island Quarry in 1954. This operation was active during the entire year. The John L. Goss Corp. quarry near Stonington and the Grenci & Sons, Inc., Hall Quarry, were idle in 1954. Joe's quarry, operated by Joseph Musetti, was

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worked part of the year for the production of irregular-shaped dimension stone, curbing, and riprap. Sand and gravel for structural and paving purposes was produced by T. W. Carlisle from the Fiske pit near Blue Hill and by Alvin R. Whitten, Winter Harbor. A small quantity of peat was produced.

Kennebec.—Kennebec County ranked as the second largest mineral-producing area in Maine. Sand and gravel production of the Maine State Highway Commission for use in road construction and maintenance was credited to this county. The only commercial sand and gravel producer was Rundstrom Bros., Gardiner; H. E. Sargent, Inc., operated a granite quarry near Farmingdale. Output was crushed and sold for concrete aggregate and road material used in the construction of the Maine Turnpike Extension.

Knox.—Cement, stone, and lime were produced in Knox County in 1954. Dragon Cement Co., Inc., operated its plant and limestone quarry in Thomaston most of the year, except for a labor strike which shut down the kilns for 28 days. The Rockland-Rockport Lime Co., Inc., Rockland, produced limestone for use as riprap and agricultural stone and in the manufacture of paper and lime. Rockland-Rockport Lime Co., Inc., also produced burnt lime. Knox Lime Co., Union, reported output of limestone for paper manufacture. Hocking Granite Industries, Inc., continued to operate its Clark Island quarry in 1954. Production consisted of architectural, monumental, and curbing stone, as well as riprap.

Oxford.—Production from the mines of Oxford County was predominantly pegmatite minerals, such as mica, beryl, and feldspar. Feldspar was produced at Foster, Perham, and Tamminen mines of Bell Minerals Co. and the Pechnik Bros. Guy Johnson mine in the South Paris-West Paris area. Feldspar was also produced by Stanley Perham and Roland Benson. Bell Minerals' output of feldspar was ground in the company mill at West Paris and sold for use in ceramic and abrasives manufacture. Beryl was obtained from the Scotty mine of the Beryllium Development, Inc., near Bethel; the Newry mine of Whitehall Co., Inc., Newry; the Mount Marie mine, South Paris, operated by Bell Minerals Co.; and the Guy Johnson mine of Pechnik Bros. near Albany. Twelve mica producers were active in Oxford County in 1954. These included Lawrence Anderson, Howard M. Irish, John L. Maderic, Sabon T. Milligan, Pechnik Bros., Stanley I. Perham, Donald N. Rich, H. L. Robinson, Strafford Mines, Inc., T. C. Mining Co., Roger W. Wheeler, and the Whitehall Co., Inc. The various mica mines were active in the Norway, Newry, Rumford, Albany Paris, and Greenwood areas. Sand and gravel for structural and paving purposes was produced by W. H. Hinman, Inc., Rumford; Homer A. Roberts and Cloyd Swett, both of Mexico; and Donald E. Wood, Norway.

Penobscot.—Sand and gravel, stone, and clays were produced in Penobscot County in 1954. Sand and gravel for structural and paving purposes was produced by Owen R. Folsom, Stillwater; G. E. Goding & Sons, Lincoln; W. H. Hinman, Inc., Millinocket; C. M. Page Co., Inc., Orono; Benjamin J. Striar Estate, Orrington. Crushed quartzite for concrete aggregate and road material was produced by Bridge

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Construction Corp. from its Read quarry near Orono. Miscellaneous clays for building brick manufacture were mined by Brooks Brick Co., Brewer.

Piscataquis.—The only mineral commodity produced in Piscataquis County in 1954 was slate from the underground mine of Portland-Monson Slate Co. at Monson. This company produced roofing, electrical, and flagging slate.

Sagadahoc.—Feldspar, sand and gravel, and columbium-tantalum concentrate were produced in Sagadahoc County in 1954. Eight feldspar mines were active. The major producers were the Consolidated Feldspar Dept., International Minerals & Chemical Corp., Topsham mine; David Ponziani, Purington mine; Ray C. Leavitt, Diamond Match mine; Cesare Trusiani, Powers mine; John Palozzi, Willis mine; Topsham Feldspar Co., Trenton mine; and Charles Chapman, Chapman mine. Consolidated Feldspar Dept., International Minerals & Chemical Corp., also operated a feldspar-grinding mill for its own and purchased crude material. Cesare Trusiani reported a small production of columbium-tantalum concentrate as a byproduct of feldspar mining. This was sold to the GSA Depot at Franklin, N. H. Sand and gravel output was reported by Almon K. Mitchell.

Somerset.—The only mineral commodity produced in Somerset County in 1954 was sand and gravel. Producers were Donald J. Gurney, Smithfield, and A. P. Wyman, Inc., Solon. Output was sold for building and paving purposes.

Waldo.—Gravels for structural, railroad ballast, and miscellaneous uses were produced by the Bangor & Aroostook Railroad and Foley & Clements. Architectural granite was produced by Grenci & Ellis, Inc., from the Mount Waldo quarry.

Washington.—Peat was the major mineral product produced in Washington County during 1954. Sand and gravel for railroad ballast and miscellaneous purposes was produced by the Maine Central Railroad and D. T. Moffett, Whitneyville. The Fletcher & Butterfield Co. quarry near Bangor was idle during 1954, but the company sold a small tonnage of monumental granite from stock. It was anticipated that the quarry would be permanently closed. The Jonesboro quarry at Quincy was also idle during the year. It was believed, however, that this quarry might reopen in 1955.

York.—The John Swenson Granite Co. worked its High Pine quarry near North Berwick and produced pink granite for architectural stone, irregular-shaped construction stone, and rubble, as well as concrete aggregate and road material. The architectural stone was used in the exterior construction of several buildings in New York and Michigan. A small quantity of sand and gravel was produced.

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The Mineral Industry of Maryland

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Maryland Department of Geology, Mines and Water Resources.

By James R. Kerr [1]

THE VALUE of mineral production in Maryland in 1954 rose 13 percent over that in the preceding year. The value of sand and gravel shipments, which rose 36 percent, more than offset the drop in clay, coal, and lime. The steady downward trend in coal production since 1947 continued, as output in 1954 was the lowest since early in 1860; it fell 21 percent below the small total mined in 1953.

Mineral production was reported from 21 counties in 1954. The principal producing counties, in order of value, were Baltimore, Washington, Prince Georges, and Frederick. Mineral products from these counties comprised 66 percent of the State mineral output of the year.

Some production data for 1954 were collected jointly with the Bureau of the Census (U. S. Department of Commerce). Production totals will be compared with the census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

TABLE 1.—Mineral production in Maryland, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	671,164	$1,135,700	627,311	$1,165,747
Coal	530,590	2,441,605	421,616	1,879,018
Lime	71,705	707,736	67,081	685,427
Natural gas—million cubic feet	1,408	268,000	1,394	282,000
Sand and gravel	7,379,511	8,919,088	10,097,800	12,171,613
Stone	[2] 3,578,250	[2] 6,275,124	5,064,526	8,265,521
Undistributed: Cement, potassium-salts, slate marble (1953), dimension limestone (1953), talc and soapstone, mica (1954), beryl (1954), greensand marl (1954)		[3] 7,337,486		7,288,888
Total Maryland		27,085,000		[4] 30,743,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes stone for cement and lime.
[3] Excludes value of clays used for cement.
[4] The total has been adjusted to eliminate duplication in the value of clays and stone.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

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REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Bituminous-coal production in 1954 dropped 21 percent from 1953 and was at the lowest point since the early 1860's. The value of coal output declined to constitute only 5 percent of the total State mineral production. Coal was produced from the mountainous western part of the State in Allegany and Garrett Counties. Approximately the same number of mines were operating in 1954 as in 1953; the difference in production can be explained by the drop of approximately 3,000 in the number of man-days worked during the year. The drop in days worked reflects the decreased market for coal again in 1954. The majority of mines in Maryland were small, producing less than 1,000 tons. The principal coal-producing properties in Allegany County were Consolidated Fuel Co. and Moran Coal Co. Larger producers in Garrett County were the Rothey Bros., W & W Coal Co., and the Progressive Coal Co.

TABLE 2.—Production of coal, 1945–49 (average) and 1950–54

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton [1]			Total	Average per ton [1]
1945–49 (average)	1,629,205	$7,345,477	$4.51	1952	587,903	$2,694,842	$4.59
1950	647,923	3,134,704	4.84	1953	530,590	2,441,605	4.60
1951	588,639	2,781,343	4.73	1954	421,616	1,879,018	4.46

[1] Value received or charged for coal f. o. b. mine, including selling cost. (Includes value for coal not sold but used by producer, such as mine fuel and coal coked as estimated by producer at average prices that might have been received if such coal had been sold commercially).

Coke.—The Bethlehem Steel Corp. at Sparrows Point, in conjunction with the manufacture of pig iron, produced coke and coke chemicals from 687 ovens at Sparrows Point plant in Baltimore County.

Natural Gas.—There were two producing natural-gas areas in Maryland—the Mountain Lake Park field and the Accident field, both in Garrett County. Although production dropped slightly (1 percent) in 1954, the value increased 5 percent.

METALS

Beryllium.—Beryl was produced for the first time in Maryland in 1954. The Green and Taylor Nurseries, Maryland mine, ceased operations August 1, 1954, after producing a small quantity of beryl from a pegmatite operation.

Copper.—The American Smelting & Refining Co., having obtained an option on a group of farms in Frederick County, reported drilling for copper. Results of the tests will determine whether the company will mine these properties, where copper mining was an important industry in colonial times.

Pig Iron.—The manufacture of pig iron, predominantly by the Bethlehem Steel Corp. at Sparrows Point, Baltimore County, was an important mineral industry in Maryland in 1954. The Sparrows

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Point plant is the second largest steel plant in the United States and in 1954 ranked third in blast-furnace capacity.

Titanium.—The Titanium Ores Corp. at Cove Point in Calvert County continued to prepare for the production of titanium minerals from beach sands on Chesapeake Bay, 65 miles south of Annapolis. A byproduct of the operation will be calcium carbonate from seashells, which the company plans to convert to agricultural lime and poultry feed.

There was no mine output of metalliferous ores in Maryland in 1954.

NONMETALS

Cement.—In terms of value, the production of cement in Maryland ranked third among the mineral products of the State in 1954. The Lehigh Portland Cement Co., Carroll County, and the North American Cement Corp., Washington County, were active during the year. Virtually all raw materials used for manufacturing cement at these two plants were obtained locally.

Clays.—The total production of clays declined 7 percent in 1954 as compared with the preceding year. The major drop was in the production of fire clay, which was 70 percent below the 1953 figure. The major clay-producing counties were Baltimore, Prince Georges, and Washington. Ninety-six percent of the total clay mined in Maryland was used by the producers. Major producers were Victor Cushwa & Sons, Inc., Washington County; Champion Brick Co., Baltimore Brick Co., and United Clay Mines Corp., all of Baltimore County; and Washington Brick Co. and West Bros. Brick Co., Prince Georges County. All the miscellaneous clay mined was used in manufacturing heavy clay products, such as building and paving brick and tile. Ninety-seven percent of the fire clay produced was used in manufacting refractories. Ball clay, fire clay, and miscellaneous clay were mined from 20 pits in 10 counties in 1954.

Gypsum.—The National Gypsum Co. calcined a considerable tonnage of imported gypsum at the Baltimore plant in Baltimore County. Of the total production, 34 percent was utilized in making plaster, 63 percent for lath and wallboard, and 3 percent for miscellaneous uses. The crude material was imported from Nova Scotia.

Iron Oxide Pigments.—The Mineral Pigments Corp. at Laurel, Prince Georges County, produced a wide variety of colors in iron oxide pigments in 1954; 60 percent of the total sales was natural material. The raw material for this operation was obtained from the Pyrites Co., Inc., Wilmington, Del.

Lime.—Lime production in Maryland declined 6 percent compared with 1953. Quicklime and hydrated lime were produced for agricultural and building purposes by 5 operators. The average value per ton increased from $9.87 in 1953 to $10.22 in 1954. The production of agricultural lime was more important; 89 percent of the total being utilized for this purpose.

Marl, Greensand.—The Kaylorite Corp. on the Patuxent River in Calvert County produced refined greensand marl from an open-pit mine for use as soil conditioner in 1954.

Mica.—The Green & Taylor Nurseries, Inc., Maryland mine produced a small quantity of full-trimmed block mica and scrap mica in

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1954 from a pegmatite operation near Simpsonville, Howard County.

Perlite.—Expanded perlite was produced at the Atlantic Perlite Co. plant in Prince Georges County and at the Perma Rock Products, Inc., in Baltimore County, from crude material mined in southwestern United States. More than four-fifths of the total output in 1954 was used as a lightweight plaster aggregate.

Potash.—The North American Cement Corp., the only potash producer in Maryland in 1954 (and in recent years), produced a substantial quantity of potash as a byproduct of the operation of its Security cement plant near Hagerstown, Washington County. The potash was sold for agricultural purposes.

Sand and Gravel.—The production of sand and gravel was the most important mineral industry in Maryland in terms of both quantity and value. Output was reported from 17 counties in 1954, compared with 10 counties in 1953; production increased 37 percent. This increase was due primarily to increased coverage due to a joint canvass with the Bureau of the Census. The more important producing counties, in decreasing order of value, were Prince Georges, Baltimore, Anne Arundel, and Harford. Pits in these counties accounted for 75 percent of the total output. Fifty percent of the total sand and gravel sales was for use in highway construction and maintenance, 47 percent for building construction, and 3 percent for miscellaneous uses. A total of 63 pits reported to the Bureau of Mines in 1954, almost twice the 1953 total of 33.

TABLE 3.—Sand and gravel sold or used by producers, 1953–54, by uses

	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Sand:						
Structural	1,769,587	$2,043,842	$1.15	2,491,035	$2,960,638	$1.19
Paving	1,373,905	1,679,071	1.22	1,880,521	2,380,477	1.27
Gravel:						
Structural	1,549,821	2,412,652	1.54	2,288,800	3,873,105	1.69
Paving	2,432,112	2,578,608	1.06	3,120,873	2,623,474	.84
Railroad ballast				11,110	25,399	2.29
Undistributed [1]	254,086	204,915	.81	305,461	308,520	1.01
Total	7,379,511	8,919,088	1.21	10,097,800	12,171,613	1.21

[1] Includes glass and engine sand and sand and gravel for miscellaneous purposes, which cannot be shown separately.

Slate.—The Central Commercial Co. continued to operate the quarry and crusher near Whiteford, Harford County, producing slate roofing granules.

Stone.—Stone ranked second in value of total mineral production in 1954. Crushed stone, largely limestone, used primarily as road stone and in manufacturing cement, concrete, and lime, constituted 76 per-

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cent of stone value. Dimension stone, quarried for construction purposes and memorials, was mostly granite but also included marble and miscellaneous stone. Ten counties reported production of stone in 1954; Baltimore, Frederick, and Washington were the more prominent, producing 89 percent of the stone total.

TABLE 4.—Stone sold or used by producers, 1953–54, by kinds and uses

Kind and use	1953		1954	
	Quantity	Value	Quantity	Value
Dimension stone:				
Granite:				
Building stone:				
Rough construction, short tons	14,688	$159,600	(1)	(1)
Rough architectural, cubic feet	5,902	6,590	(1)	(1)
Rubble, short tons	28,915	92,393	(1)	(1)
Curbing, cubic feet	17,377	13,050	(1)	(1)
Total (approximate short tons)	45,513	271,633	(1)	(1)
Miscellaneous: Building:				
Rough and dressed, short tons	7,943	45,864	8,499	$46,828
Rubble and flagging, do	1,637	13,968	1,484	13,631
Total, do	9,580	59,832	9,983	60,459
Crushed and broken stone: Granite:				
Riprap, do	14,100	49,350	10,500	36,750
Crushed stone, do	49,667	111,807	60,344	138,838
Total, do	63,767	161,157	70,844	175,588
Basalt and related rocks, do	729,857	1,248,214	(1)	(1)
Limestone:				
Riprap, do	35,400	61,950	61,020	113,668
Crushed stone, do	2,541,846	3,886,907	2,975,605	4,604,119
Agricultural, do	56,737	227,195	58,011	244,135
Miscellaneous, do	[2] 95,094	358,008	1,016,197	1,332,601
Total, do	2,729,077	4,534,060	4,110,833	6,294,523
Miscellaneous stone: Riprap, do	456	228		
Undistributed [3], do			872,866	1,734,951
Grand total, do	[4] 3,578,250	[4] 6,275,124	5,064,526	8,265,521

[1] Figure withheld to avoid disclosure of individual company operations, included with "Undistributed."
[2] Exludes stone for cement and lime in 1953.
[3] Includes dimension granite, marble, basalt and related rocks and dimension limestone.
[4] Exludes certain stone; Bureau of Mines not at liberty to publish.

Talc and Soapstone.—Talc and soapstone production was reported by two companies, the Clinchfield Sand & Feldspar Corp., Carroll County; and the Harford Talc & Quartz Co., Inc., Harford County. The bulk of the mining output was sold as ground material for use as asphalt filler, roofing material, and in the ceramic industry.

Vermiculite (Exfoliated).—Crude vermiculite mined by producers from southeastern United States was processed by the Vermiculite Products Corp. and the Carolina Vermiculite Co., Prince Georges County, in 1954.

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TABLE 5.—Value of mineral production in Maryland, 1953–54, by counties[1]

County	1953	1954	Minerals produced in 1954, in order of value
Allegany	$1,540,868	$1,709,915	Coal, sand and gravel, stone, clays.
Anne Arundel	1,635,981	(2)	Sand and gravel, clays.
Baltimore	7,232,089	6,944,568	Stone, sand and gravel, clays.
Calvert		(2)	Green sand marl.
Carroll	2,777,577	(2)	Cement, soapstones.
Cecil	346,936	742,561	Sand and gravel, clays.
Charles		(2)	Sand and gravel.
Dorchester		(2)	Do.
Frederick	1,982,907	2,571,816	Stone, lime, clays.
Garrett	2,124,829	1,498,285	Coal, natural gas, stone, sand and gravel.
Harford	1,132,592	1,497,089	Sand and gravel, stone, slate, soapstone.
Howard		50,398	Sand and gravel, stone, mica, beryl.
Kent		337,121	Sand and gravel, clays.
Montgomery	50,760	414,424	Sand and gravel, stone.
Prince Georges	2,641,726	5,101,605	Sand and gravel, clays, stone.
Queen Anne		(2)	Sand and gravel.
St. Marys		(2)	Do.
Talbot		(2)	Sand and gravel, clays.
Washington	4,971,196	5,312,583	Cement, stone, clays, potash.
Wicomico		103,287	Sand and gravel, clays, lime.
Worcester		(2)	Sand and gravel.
Undistributed	647,278	4,459,615	
Total	27,085,000	[3]30,743,000	

[1] The following counties were not listed because no production was reported: Caroline and Somerset.
[2] Values included with "Undistributed."
[3] Excludes value of stone used for lime and cement.

REVIEW BY COUNTIES

Allegany.—The production of coal in Allegany County dropped again in 1954. At least 67 mines, most of which produced less than 1,000 tons, were active at one time during the year. The principal coal-producing properties in 1954 were the Consolidated Fuel Co. and the Moran Coal Co. Other large producers were the M. H. Bigan Co., the Ajax Coal Co., and the Roaring Ben Coal Co.

In addition to the mining of coal, sand and gravel, stone, and clays were produced. The Cumberland Cement & Supply Co., the primary producer of sand and gravel, operated two plants—Quartzite No. 1, a quarry on the side of a mountain near Cumberland, and the River plant, which processed material dredged from the Potomac River. This company also produced crushed limestone for use primarily in making ready-mixed concrete from Rock Cut quarry at Corrigansville. Fire clay, used in manufacturing fire brick and block, was mined by Mount Savage Refractories Co., Mount Savage; and Big Savage Refractories Corp., Frostburg. Miscellaneous clay, for use in making brick and tile products, was mined by Pen-Mar Brick & Supply Co., Cumberland.

Anne Arundel.—Sand and gravel and clays were the mineral commodities produced in Anne Arundel County in 1954. The Arundel Corp., the major producer, operated the Pasadena-Masonville and Linthicum sand and gravel plants at Baltimore City. Frederick Link Sons (Hanover) and the Brooklyn Corp. (Curtis Bay) were other large producers of sand and gravel. The Severn Clay Co., the only clay producer in the county, mined fire clay for use in the manufacture of sanitary ware and high-grade tile from an open-pit mine at Glen Burnie.

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Baltimore and Baltimore City.—In order of decreasing value, stone, sand and gravel, and clay were the mineral commodities produced in Baltimore County in 1954. Harry T. Campbell & Sons Corp. was the leading producer. This company produced (1) the major portion of the county crushed limestone total from the Texas quarry near Texas; (2) the bulk of the county output of granite from the Loch Raven quarry, Towson, and Butler quarry and Butler and Gwynn Falls quarry, Baltimore; (3) the major portion of the total county output of sand and gravel from the White Marsh operation.

Crushed limestone was produced from Arundel Corp. Green Spring quarry near Baltimore. Carl B. Temple produced crushed granite for use in making concrete from a quarry near Recordville. The production of miscellaneous clay was reported by Champion Brick Co. near Baltimore and by the Monument Street and Rossville plants of Baltimore Brick Co. The primary use of the product was for manufacturing heavy clay products, such as building brick and tile. Ball clay was mined by United Clay Mines Corp. from an open pit near White Marsh for use primarily as a filler and in manufacturing high-grade tile. There were eight active sand and gravel pits in the county in 1954. More than fourth-fifths of the output was used in making ready-mixed concrete. Producers were Harry T. Campbell & Sons Corp., White Marsh; The Arundel Corp., Baltimore; Nottingham Farms, Inc., Baltimore; Clark Certified Concrete Co., Carney; George W. Schwarz, White Marsh; Caton Corp., Halethorpe; Louis H. Richter, Fullerton; and Charles B. Polense, Fullerton. Expanded perlite for use as a lightweight aggregate was processed by Perma Rock Products, Inc., Baltimore, from raw material received from Socorro Mines, New Mexico. The Bethlehem Steel Corp. produced pig iron, coke, and coke chemicals at Sparrows Point.

Calvert.—The Kaylorite Corp. at Dunkirk produced a small quantity of greensand marl for use as a soil conditioner. Sand and gravel was produced at scattered small pits.

Carroll.—Cement, talc, and stone were the mineral products of Carroll County in 1954. The Lehigh Portland Cement Co. initiated a $15 million expansion of the Union Bridge plant at Sams Creek. When construction is completed late in 1956, the output of the plant will be approximately three times its present capacity. The Clinchfield Sand & Feldspar Corp. near Marriottsville produced a considerable quantity of talc as ground material for use in making roofing and as an asphalt filler.

Cecil.—Sand and gravel was the principal mineral product of Cecil county in 1954. Six commercial pits were active during the year. The two larger producers were Mason-Dixon Sand & Gravel Co., Perryville, and the new Arundel Corp. water operation on the Elk River. The Arundel Whitehall plant was dismantled as the deposit was exhausted. Other producers were C. Ray Ott and Vernon Kincaid, Elkton; Arthur D. Johnston, Rising Sun; and McDaniel Sand & Gravel Co., Inc., North East. Fred S. Russell, the only clay producer, mined fire clay from an open pit near North East for use in manufacturing fire brick and block. Ground was broken for a new silica-refractory plant at Leslie by Harbison-Walker Refractories Co. The $3 million plant will be of the most advanced design, utilizing the latest laboratory and pilot-plant developments.

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Charles.—Sand and gravel, mined by A. D. Gamble & Son (La Plata) and the Maryland Sand & Gravel Co., (Aberdeen), was the only mineral commodity produced in Charles County in 1954.

Dorchester.—Sand and gravel, produced by J. Edwin Rosser, Federalsburg, for building purposes, was the only mineral produced in Dorchester County in 1954.

Frederick.—In order of decreasing value, stone, lime, and clays were the minerals produced in Frederick County in 1954. Crushed limestone, used primarily for road stone and concrete aggregate, was the only stone produced. The M. J. Grove Lime Co., Lime Kiln, was the largest stone producer, mining over four-fifths of the county total. Other producers were the Le Gore Lime Co., Le Gore; S. W. Barrick & Sons, Inc., Woodsboro; and Farmers Cooperative Association, Inc., Frederick. The bulk of the lime produced in Maryland in 1954 originated in Frederick County. S. W. Barrick & Sons Inc., (Woodsboro), M. J. Grove Lime Co. (Lime Kiln), Le Gore Lime Co. (Le Gore), and Everett V. Moser (Middletown) were producers. The major portion of lime produced was used for agricultural purposes. The Hudson Supply & Equipment Co., Buckeystown, produced miscellaneous clay used in manufacturing heavy clay products.

Garrett—Coal, natural gas, limestone, and sand and gravel, in order of value of output, were the mineral commodities produced in Garrett County in 1954. The majority of 76 coal mines active during the year produced less than 1,000 tons each. Major coal producers were the Rothey Bros., W & W Coal Co., and Progressive Coal Co. Other large producers were Carr & Glotfelty Construction Co., Myers Coal Co., Inc., and Aladdin Fuels, Inc. Crushed limestone, used primarily as road stone and in making concrete, was produced from the Fry and Browning quarries of Vetter Bros., Inc., near Oakland. Sand and gravel was produced by the Silver Knob Sand Co., Oakland, and the Eagle Rock Sand Co., Oakland.

Harford.—Sand and gravel was the most important mineral produced in Harford County in 1954. S. Stancills, Inc., which operated pits and plants at Aberdeen, Edgewood, Joppa, and Mountain Road, was the largest producer. Other large producers were Charleston Sand & Gravel Co. and W. Noble Hamilton, Aberdeen; and Abingdon Sand & Gravel Co. and Belcamp Sand & Gravel Co., Abingdon. Slate for the manufacture of roofing granules was produced by the Central Commercial Co. from a quarry and crusher near Whiteford. Thomas B. Gatch & Sons, Inc., produced crushed basalt from the Churchville quarry, Churchville, for use as road stone and in making concrete. The Maryland Green Marble Co. continued to produce Maryland verde antique, a serpentine marble, from a quarry near Cardiff. The product was used for building interiors and was also crushed for terrazzo. Talc was mined by the Harford Talc & Quartz Co. Inc., near Dublin for use in manufacturing ceramics and foundry facings.

Howard.—Sand and gravel was produced by the Cosca Sand & Gravel Co. from a pit at Waterloo. Small quantities of dimension stone were produced by the Ivory Pearl Quarries, Marriottsville and F. D. Nichols, Clarksville. The Green & Taylor Nurseries, Inc., pro-

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duced small quantities of mica and beryl from the Maryland mine near Simpsonville.

Kent.—Sand and gravel and clay were the minerals produced in Kent County in 1954. Sand and gravel was produced by the Kent Concrete Co., Chestertown, and Kaiss Bros. Sand Co. near Baltimore. The product was used primarily in construction and roadmaking. Clay was produced by the Chestertown Brick Co. for use in manufacturing heavy clay products.

Montgomery.—Sand and gravel and stone were produced in Montgomery County in 1954. Wm. H. McCeney, Jr., Inc., opened a bank operation near Silver Spring and produced washed sand and gravel. Most of the stone output in the county was mica schist for building and flagging purposes, although some broken stone for use as riprap was also produced. Stone producers were Stoneyhurst Quarries, and Segreti Bros., Bethesda; and Albert D. Battista, Rockville.

Prince Georges.—Prince Georges County ranked first in the production of sand and gravel in Maryland; over two-fifths of the State total was mined here. Only 4 pits were active in 1953; 13 were producing in 1954. Total output more than doubled. Smoot Sand & Gravel Corp., operator of a dredge on the Potomac River, continued as the largest producer. Some of the other large producers were the Contee Sand & Gravel Co., Inc., Laurel; Buffalo Sand & Gravel Co., Camp Springs; Silver Hill Sand & Gravel Co., Silver Hill; Forestville Sand & Gravel Co., Forestville; and the Arundel Supply Co., District Heights. Wm. L. Allen, Laurel, produced plastic fire clay for use in foundries. Miscellaneous clay for use in making heavy clay products was mined by the Washington Brick Co., Muirkirk; and West Bros. Brick Co., near Washington, D. C. A small quantity of miscellaneous dimension stone was produced by Frank Pennini at the Congressional quarry for his own use. Expanded perlite, sold primarily for use as a lightweight aggregate, was produced by the Atlantic Perlite Co. at its plant near Washington, D. C. Exfoliated vermiculite was processed by the Carolina Vermiculite Co., Beaver Heights, and the Vermiculite Products Corp., Kenilworth, from crude material recevied from North Carolina.

Queen Annes.—Sand and gravel was the only mineral commodity produced in Queen Annes County in 1954. R. B. Baker & Sons, Inc., Queenstown, was the only operator. The product was used primarily in construction.

St. Marys.—Sand and gravel, the county's only mineral commodity, was produced by the Leonardtown Sand & Gravel Co., Leonardtown, for use in building and paving. Joseph A. Dilflow, owner of a sand and gravel pit at Leonardtown, leased the pit to the State highways commission, which utilized the material in upkeep of State roads.

Talbot.—The New Brick & Tile Co., Easton, produced miscellaneous clay for use in manufacturing heavy clay products, such as building brick and drain tile. The Talbot County Highway Department produced sand and gravel for its own use.

Washington.—The major commodity in Washington County again in 1954 was cement produced at the North American Cement Corp. Security plant 2 miles east of Hagerstown. An important byproduct

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of the cement-making process, sulfate of potash, was sold for agricultural purposes. In addition to the production of crushed limestone for its own consumption, the North American Cement Corp. sold a considerable quantity for use as road-stone and in making concrete. Broken limestone was produced by Joseph H. Forsyth, Williamsport, for use as riprap. The plant was closed at the end of 1954. Miscellaneous clay for use in manufacturing heavy clay products was mined by Victor Cushwa & Sons, Inc., Williamsport.

Wicomico.—Sand and gravel was mined by Basic Materials Supply Co., Salisbury; and Richard Howard, Hebron. Miscellaneous clay was produced by the Salisbury Brick Co., Inc. Salisbury, for use in manufacturing brick.

Worcester.—Sand and gravel, mined by Blades Sand & Gravel Co., and the Steward's Sand & Gravel Co., both of Pocomoke City, was the only mineral commodity produced in 1954.

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The Mineral Industry of Massachusetts

By Alvin Kaufman [1] and C. Geraldine Cleary [2]

THE VALUE of Massachusetts mineral production rose 10 percent in 1954, compared with 1953, to establish a new record high despite a decline in the dollar value of most of the commodities. The increase resulted primarily from a 41-percent rise in the value of sand and gravel output.

The principal mineral commodities produced in Massachusetts were stone, sand and gravel, and lime. These represented 99 percent of the value of mineral output in 1954. Major producing counties, in order of value, were Middlesex, Berkshire, and Norfolk. Middlesex County owed its predominant position to the production of stone. Berkshire County ranked second, primarily because of concentration of the lime industry within its borders. The chief mineral product of Norfolk County was sand and gravel. Some production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

TABLE 1.—Mineral production in Massachusetts, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	152,117	$195,837	128,998	$121,049
Lime (open-market)	135,383	2,156,205	127,836	1,709,341
Peat	2,061	15,962	(2)	(2)
Sand and gravel	7,308,190	5,930,894	9,640,274	8,366,409
Stone	[3] 3,457,708	[3] 8,821,108	2,942,435	9,039,590
Undistributed: Quartz (1953), recovered elemental sulfur, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2)		71,368		12,077
Total Massachusetts		17,191,000		[4] 18,851,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Value included with "Undistributed."
[3] Excludes limestone for lime.
[4] Total has been adjusted to eliminate duplication in value of raw materials used in the manufacture of cement.

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REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Production of clays in Massachusetts declined 15 percent in quantity and 38 percent in value in 1954 compared with 1953. Output was consumed by producers for the manufacture of building brick and other heavy clay products. Clays were produced from 7 pits in 5 counties. Plymouth and Hampden Counties were the major producing areas; Bristol, Middlesex, and Franklin Counties followed in that order.

Lime.—Production of quick and hydrated lime decreased 6 percent in tonnage and 21 percent in value in 1954 compared with 1953. The average values for each type of lime declined; the most significant drop occurred in the value of chemical and industrial limes, which decreased from $16.69 per ton in 1953 to $13.09 in 1954.

Chemical and industrial limes comprised 67 percent of the total tonnage and building lime, 23 percent; the remaining 10 percent was sold for agricultural purposes.

TABLE 2.—Lime (quick and hydrated) sold by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1945–49 (average)	109,166	$1,178,486	$10.80	1952	132,135	$1,999,545	$15.13
1950	139,357	1,830,625	13.14	1953	135,383	2,156,205	15.93
1951	143,316	1,930,225	13.47	1954	127,836	1,709,341	13.37

Perlite.—Expanded perlite was produced at the Roslindale, Suffolk County, plant of The Whittemore Co., Permalite Division, from crude perlite mined in southwestern United States. Over 70 percent of the plant output was used as a lightweight aggregate for plaster; the remainder was utilized in concrete manufacture.

Roofing Granules.—Bird & Son manufactured roofing granules from locally produced stone in 1954 at its plant in East Walpole.

Sand and Gravel.—The production of sand and gravel increased 32 percent in quantity in 1954 compared with 1953. Because of improved coverage of the industry, production was reported from 119 commercial pits in 1954 compared with 73 in 1953. Structural and paving sand and gravel comprised the major portion of production, comprising 47 percent and 41 percent of the total quantity, respectively. Blast, engine, filter, molding, railroad ballast, and miscellaneous sands and gravels were also produced. The average value of sand and gravel rose from $0.81 per ton in 1953 to $0.87 in 1954. Sand and gravel produced by commercial producers rose from $0.88 the previous year to $0.93 in 1954. The largest increment, however, was the rise from $0.23 per ton to $0.45 in the average value of sand and gravel produced by Government and contractor operations. The major producing counties were Middlesex, Norfolk, Suffolk, and Worcester. These 4 counties together supplied 63 percent of the total

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State output of sand and gravel. Boston Sand & Gravel Co., Norfolk County and Highland Sand & Gravel Co., Inc., Middlesex and Norfolk Counties, were the largest producers.

TABLE 3.—Sand and gravel sold or used by producers 1953–54, by classes of operations and uses

Uses	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Molding	(1)	(1)	(1)	75,659	$220,133	$2.91
Structural	2,008,038	$1,635,055	$0.81	2,358,350	2,089,256	.89
Paving	778,576	643,658	.83	1,272,819	1,039,583	.82
Other	29,930	22,650	.76	105,588	66,996	.63
Gravel:						
Structural	1,959,185	2,178,423	1.11	2,136,630	2,520,786	1.18
Paving	901,757	661,218	.73	1,461,241	1,310,807	.90
Other	661,812	304,476	.46	919,055	492,060	.54
Undistributed [2]	160,073	298,527	1.86	55,963	60,054	1.07
Total commercial sand and gravel	6,499,371	5,744,007	.88	8,385,305	7,799,675	.93
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Structural	11,710	27,701	2.37	19,437	46,080	2.37
Paving	56,464	63,687	1.13	97,357	86,361	.89
Gravel:						
Structural	11,585	23,723	2.05	22,300	38,980	1.75
Paving	729,060	71,776	.10	1,115,875	395,313	.35
Total Government-and-contractor sand and gravel	808,819	186,887	.23	1,254,969	566,734	.45
Grand total	7,308,190	5,930,894	.81	9,640,274	8,366,409	.87

[1] Included with "Undistributed" to avoid disclosure of individual company operations.
[2] Includes blast sand (1954), engine sand, filter sand, railroad ballast (gravel), and those uses designated by footnote 1.

Stone.—Twenty-nine stone quarries were active in Massachusetts in 1954; of these 14 produced granite, 9 basalt, 4 limestone, 1 sandstone, and 1 miscellaneous stone. Granite and sandstone were the only dimension stones produced in the State; dimension output comprised 4 percent of total stone tonnage and 44 percent of value.

The quantity of stone produced dropped 15 percent compared with 1953, primarily because of a 16-percent decline in the quantity of rock sold for concrete aggregate and roadstone, while the value of stone increased 2 percent. The small increase in value was due to a 36-percent rise in dimension stone output with its accompanying high unit values, which counterbalanced the drop in concrete aggregate and roadstone production.

Essex, Norfolk, Middlesex, and Suffolk Counties were the major stone-producing areas.

Vermiculite.—Two plants in Middlesex County produced exfoliated vermiculite from material imported from southwestern United States. Output was used for plaster and concrete aggregate, house insulation, and miscellaneous applications.

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TABLE 4.—Stone sold or used by producers, 1953–54, by uses

	1953		1954	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone:				
Rough construction, short tons	(1)	(1)	16,907	$223,061
Cut stone, slabs, and mill blocks, cubic feet	228,788	$1,397,309	(1)	(1)
Monumental stone, cubic feet	[2] 10,435	[2] 52,744	[2] 10,845	[2] 67,748
Undistributed [3], short tons	66,290	1,972,990	98,943	3,734,887
Total dimension stone (quantities approximate in short tons)	86,008	3,423,043	116,745	4,025,696
Crushed and broken stone:				
Riprap, short tons	[4] 34,989	[4] 33,779	[4] 41,380	[4] 59,136
Concrete, roadstone, do	3,052,069	4,337,549	2,210,387	3,537,821
Railroad ballast, do	(5)	(5)	73,363	87,683
Agricultural (limestone), do	102,270	366,379	100,701	370,327
Other uses, do	152,158	575,420	153,054	489,227
Undistributed [6], do	30,214	84,938	246,805	469,700
Total crushed and broken stone, do	3,371,700	5,398,065	2,825,690	5,013,894
Grand total (quantities approximate in short tons)	3,457,708	8,821,108	2,942,435	9,039,590

[1] Included with "Undistributed."
[2] Excludes dressed monumental stone.
[3] Includes rubble, rough architectural (1954), dressed architectural and construction (1954), paving blocks, curbing and flagging and uses indicated by footnotes 1 and 2.
[4] Excludes granite.
[5] Included with concrete, roadstone (1953).
[6] Includes crushed granite, furnace flux and limestone for lime and cement (1954), and uses indicated by footnote 4.

MINERAL FUELS

Peat.—A small quantity of peat for local agricultural use was recovered from bogs in Essex County in 1954.

REVIEW BY COUNTIES

Barnstable.—Eight mineral producers were active in Barnstable County in 1954. These produced sand and gravel and crushed granite. Sand and gravel output was obtained from the pits of Concrete Products Co. and Frederick V. Lawrence, Inc., both in Falmouth; Sorenti Bros., Cedarville; Whitehead Bros. Co., Provincetown; and the Boston & Maine Railroad and Nathan A. Nickerson, Eastham. Output of these pits was sold primarily for structural and paving purposes, although there was a substantial production for molding, blast, engine, and miscellaneous purposes. Granite for use as riprap was quarried near Falmouth by Turner & Breivogel, Inc.

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TABLE 5.—Value of mineral production in Massachusetts, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value
Barnstable	$233,875	$216,139	Sand and gravel, stone.
Berkshire	3,399,149	2,848,586	Lime, stone, sand and gravel.
Bristol	943,331	1,173,616	Sand and gravel, stone, clays.
Dukes	(2)	(2)	Sand and gravel.
Essex	1,495,525	1,501,802	Stone, sand and gravel, peat.
Franklin	293,181	174,860	Stone, sand and gravel, clays.
Hampden	1,453,346	725,630	Sand and gravel, stone, clays.
Hampshire	(2)	(2)	Sand and gravel.
Middlesex	4,655,730	6,359,065	Stone, sand and gravel, clays, sulfur.
Norfolk	2,134,898	2,359,924	Sand and gravel, stone.
Plymouth	487,715	688,587	Sand and gravel, stone, clays.
Suffolk	615,263	1,121,812	Stone, sand and gravel.
Worcester	1,313,514	1,549,101	Sand and gravel, stone.
Undistributed	165,819	131,750	
Total	17,191,000	18,851,000	

[1] Nantucket County was not listed because no production was reported.
[2] Included with "Undistributed."

Berkshire.—Lime, sand and gravel, and stone were produced in Berkshire County in 1954. Quicklime and hydrated lime were produced from limestone quarried by Lee Lime Corp., Lee; New England Lime Co., Adams; and United States Gypsum Co., Farnams. Production was sold for building, agricultural, chemical, and industrial uses. These companies also produced crushed limestone for blast-furnace flux, agricultural stone, and miscellaneous uses. Building and paving sand and gravel were produced in 1954 by Berkshire Gravel, Inc., Lenox Dale and Pittsfield; Frank Bushika, Cheshire; General Sand & Stone Corp., Dalton; Hutchinson Sand & Gravel Co., Inc., Dalton and Pittsfield; Maxymillian, Inc., Adams; and Mountain Sand & Gravel Co., Inc., Great Barrington. Dimension granite for rough monumental stone was produced by Otis Chester Granite Co., Inc., from the Whiting Quarry near Otis. Crushed sandstone was produced in Berkshire County by the City of North Adams for road building.

Bristol.—Sand and gravel, dimension granite, and clays were mined in Bristol County in 1954. Of the 14 commercial sand and gravel producers active in that year the largest were: Joseph Borge & Sons, Inc., Swansea; McCabe Sand & Gravel Co., Taunton; Morse Sand & Gravel Co., Attleboro; Pine Hill Sand & Gravel Co., Westport; J. J. Stevens Co., Fall River; Swansea Sand & Gravel Co., Swansea; Thomas Bros. Corp., Raynham; Brockton Sand & Gravel Co., Inc., South Easton; River Sand & Gravel Co., Seekonk; and Montaup Sand Gravel & Construction Corp., Swansea. Output of these pits was used mostly for structural and paving purposes. Crushed and broken granite for use as riprap, concrete aggregate, and roadstone was produced by Blue Stone Quarry Division of Warren Bros. Roads Co. near Acushnet. Stiles & Hart Brick Co. continued to work its clay pit at Taunton during the year. This commodity was utilized in the manufacture of brick and other heavy clay products.

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Dukes.—The only mineral producer in Dukes County in 1954 was the Colby Construction Co., which mined sand and gravel for building and paving purposes from its property at Oak Bluffs.

Essex.—Stone, sand and gravel, and peat were produced in Essex County in 1954. Lynn Sand & Stone Co., Trimount Bituminous Products Co., and Essex Sand & Gravel Co. operated the Swampscott, Saugus, and West Peabody basalt quarries, respectively.

The principal crushed use of basalt was as concrete aggregate and roadstone. Output was also used for railroad ballast, roofing granules, and riprap. Dimension granite was yielded by the Johnson quarry of Karl A. Person in Rockport. Sand and gravel was produced by Essex Sand & Gravel Co., Andover; W. Heinrich & Sons, Inc., Lawrence; Miles River Sand & Gravel, Inc., Ipswich; Henry Ouellette & Sons, Methuen; Topsfield Sand & Gravel Co. and Robert W. Sims, Topsfield; Videtta Construction Co., West Peabody; Wright Contracting Co., Danvers; and Yemma Bros., Inc., Haverhill. Massachusetts Peat Humus Co. recovered peat for soil-improvement uses from bogs near Lawrence.

Franklin.—Greenfield Massachusetts Broken Stone Co. produced riprap, concrete aggregate, roadstone, and railroad ballast from its quarry near Deerfield. Building sand was produced by the Mackin Sand & Concrete Products Co. near Greenfield. Miscellaneous clays for use in manufacturing heavy clay products were produced from an open-pit near Greenfield by R. E. Pray & Co.

Hampden.—Sand and gravel for structural, paving, and miscellaneous uses was produced in Hampden County in 1954 by Banas Sand & Gravel Co., Ludlow; Jerry E. Baxter, East Springfield; Edward N. Christianson Sand Co., Monson; R. Lavoie Trucking Co., Chicopee Falls; North Wilbraham Sand & Gravel Co., Springfield; John F. Porter Sons, Westfield; Western Massachusetts Sand & Gravel, Inc., Westfield; D. D. Ruxton Co., Inc., Ludlow; John Lizak, Palmer; and E. A. Jenson & Sons, Inc., Granville Center. Hampden County was the only area in Massachusetts in which dimension sandstone was produced. McCormick Longmeadow Stone Co., Inc., at East Longmeadow, produced a dressed architectural stone in 1954. Hampshire Brick Co. and Westfield Clay Products Co. continued to work clay pits at Chicopee and Westfield. Clays produced were used in manufacturing building brick.

Hampshire.—Sand and gravel for structural and paving purposes was produced in Hampshire County in 1954 by A. Giard & Sons, Inc., Ware; Hampshire Sand & Gravel, Inc., Westhampton; and Omasta Bros., Northampton.

Middlesex—In value of mineral output Middlesex County ranked as the most important producing area in Massachusetts in 1954. Stone, sand and gravel, clays, and elemental sulfur were produced. The most important mineral commodity was dimension granite from the quarries of the H. E. Fletcher Co. and Morris Bros. Granite Co., Inc., both at Westford. Production from the Fletcher Co. quarry consisted of building stone, monumental stone, paving blocks, and curbing. The Morris Bros. Granite Co., Inc., produced curbing and flagging only.

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The H. E. Fletcher Co. also produced crushed granite for concrete aggregate, roadstone, and agricultural purposes. B. & M. Crushed Stone Corp., Ashland, also produced crushed granite. The Winchester quarry of Winchester Crushed Stone Co. yielded basalt for concrete aggregate and roadstone. A granite gneiss for road construction was produced by John P. Condon Corp., Dracut. Middlesex County also ranked as the major stone- and sand-and-gravel-producing area in the State in 1954. Sand and gravel for structural, paving, railroad ballast, and miscellaneous uses was produced from 22 pits. Of these the 11 largest were Acme Sand & Gravel Co., Inc., and Akeson Sand & Gravel Co., both of Woburn; Lexington Sand & Gravel Co., Framingham and Acton; Riverside Sand & Gravel Co., Newton Lower Falls; San-Vel Contracting Co., Littleton; Kennedy Bros., Acton; Ashland Sand & Gravel Co., Inc., Holliston; Assabet Sand & Gravel Co., Inc., South Acton; Frank Generazio, Framingham and Highland Sand & Gravel Co., Burlington.

A. D. Hews & Co., Inc., continued to produce miscellaneous clays for use in manufacturing flower pots at its pit near Cambridge. The Boston Consolidated Gas Co. reported output of sulfur paste from its Boston plant. This material was recovered by the Thylox liquid purification process as a byproduct of gas production. Exfoliated vermiculite from crude material imported from the southwestern United States was produced by California Stucco Products Inc., and the Zonolite Co. at their Cambridge and North Billerica plants, respectively.

Norfolk.—Norfolk County dropped from first to second place as a sand-and-gravel-producing area in 1954. Thirteen commercial pits were active. The largest of these were Boston Sand & Gravel Co., Canton; Joseph Columbo & Sons, Dedham; Glacier Sand & Stone Co., Inc., Norwood; Highland Sand & Gravel Co., Inc., with pits at Walpole and Dedham; Tresca Bros., Newton Center; Varney Bros. Sand & Gravel Co., Bellingham; A. A. Will Sand & Gravel Corp., Canton; Frank W. Weaver, East Weymouth; Edward T. Dwyer Sand & Gravel Corp., Braintree. Output consisted predominantly of building and paving sand and gravels.

Old Colony Crushed Stone Co., Bates Bros. Seam Face Granite Co., and J. S. Swingle, Inc., all near Quincy, produced dimension granite for building and monumental purposes as well as crushed stone. Stoughton Crushed Stone Co., Stoughton, produced concrete aggregate and roadstone from its basalt quarry.

Plymouth.—Sand and gravel, stone, and clays were produced in Plymouth County in 1954. In value of production, sand and gravel was the most important commodity produced. The active producers in 1954 were Boston Sand & Gravel Co., Greenbush; Bradford Weston, Inc., Hingham; Bridgewater Sand & Gravel, Bridgewater; Marshfield Sand & Gravel Co., Marshfield; Petrino Co., Whitman; Thomas Bros., Middleboro; Whitehead Bros. Co., Wareham; Albert W. Winters, Marion; and A. K. Finney Co., Plymouth. Bradford Weston Inc., Hingham, also operated a granite quarry that yielded crushed and broken material for use as riprap, concrete aggregate, and paving stone. Plymouth County was the largest clay producing area in the

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State. Output was used in manufacturing building brick and was mined by the Stiles & Hart Brick Co., South Bridgewater, and Bridgewater Brick Co., East Bridgewater.

Suffolk.—West Roxbury Crushed Stone Co., continued to operate its granite quarry at West Roxbury; and William J. Barry Co., Roslindale, and Rowe Contracting Co., Suffolk, produced a crushed and broken basalt for highway construction and riprap. The United States Army Corps of Engineers reported production of sand and gravel.

Worcester.—Sand and gravel and stone were produced in Worcester County in 1954. The county ranked third in value of output of sand and gravel. Eighteen sand and gravel pits produced this commodity for use as molding sand, building, and paving material, as well as for railroad ballast. Largest producers were E. L. Dauphinais, Inc., North Grafton; De Falco Concrete, Inc., Millbury; P. J. Keating Co., Lunenburg; Joseph Rosenfeld, Hopedale; and Worcester Sand & Gravel Co., Inc., Shrewsbury. H. E. Fletcher Co. and Uxbridge Granite Co. produced building stone from their granite quarries near Milford and Uxbridge, respectively. The bulk of the county stone production, however, was a crushed basalt quarried by the Holden Trap Rock Co., Holden.

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The Mineral Industry of Michigan

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Michigan Department of Conservation, Geological Survey Division, State of Michigan.

By D. H. Mullen [1]

MINERAL production in Michigan in 1954 was valued at $279.9 million, a decrease of $6.5 million (2 percent) below 1953. Decreases were reported in shipments of the following metals: Iron ore, 27 percent; manganiferous ores, 80 percent; and copper, 2 percent. The value of shipments decreased 26 percent for iron ore and 78 percent for manganiferous ores and increased less than 1 percent for copper. The total value of fuels, petroleum, natural gas, natural-gas liquids and peat decreased less than 1 percent.

TABLE 1.—Mineral production in Michigan, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement, portland ---- 376 pound barrels	15,853,096	$41,860,464	16,711,710	$45,691,867
Clays	1,645,804	1,686,113	1,870,814	1,919,204
Copper (recoverable content of ores, etc.)	24,097	13,831,678	23,593	13,919,870
Gypsum	1,446,973	4,091,002	1,693,279	5,035,550
Iron ore (usable) ---- long tons, gross weight	13,312,766	94,691,612	9,709,167	70,004,504
Magnesium compounds	43,190	4,591,922	37,038	4,103,766
Manganiferous ores (5 to 35 percent Mn) -- gross weight	76,251	[2]	15,361	[2]
Marl, calcareous (except for cement)	183,685	72,781	106,668	37,724
Natural gas ---- million cubic feet	7,774	1,275,000	6,962	1,239,000
Peat	25,439	257,176	27,847	429,116
Petroleum (crude) ---- thousand 42-gallon barrels	12,285	35,870,000	12,028	35,600,000
Salt (common)	5,127,387	22,171,988	5,063,633	29,396,812
Sand and gravel [3]	30,463,463	23,170,802	32,040,639	25,516,169
Stone (except limestone for cement and lime, 1953)	21,615,686	17,639,525	27,758,443	21,904,517
Undistributed: Bromine, calcium chloride and calcium-magnesium chloride, iron oxide pigments (1954) lime, magnesium chloride, natural gasoline and LP-gases, potassium salts, ground sand and sandstone (1953), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2)	----	[4] 25,276,772	----	29,052,541
Total Michigan	----	286,487,000	----	[5] 280,150,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Value included with "Undistributed."
[3] Includes friable sandstone.
[4] Excludes value of clays used for cement.
[5] Total has been adjusted to eliminate duplication in value of clays and stone.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Minneapolis, Minn.

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The total value of nonmetallic minerals was $158.4 million or 57 percent of the total mineral production in 1954—an increase of 14 percent over 1953. Increases were noted in the value of cement, 9 percent; gypsum, 23 percent; salt, 33 percent; sand and gravel, 10 percent; and stone, 24 percent.

Data for stone in 1954 are not strictly comparable with those for previous years because of changes in the method of tabulation.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences of coverage.

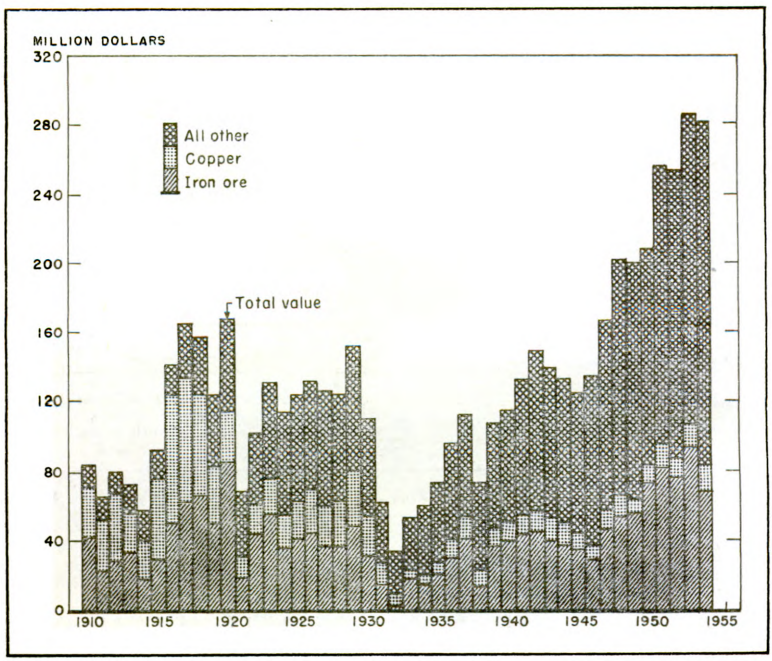

FIGURE 1.—Value of copper and iron ore, and total value of all minerals produced in Michigan, 1910–54.

REVIEW BY MINERAL COMMODITIES

METALS

Copper.—Production of copper, in terms of recoverable metals, from 13 underground operations and 2 tailings-reclamation plants in Houghton, Keweenaw, and Ontonagon Counties totaled 23,600 short tons (valued at $14 million) in 1954, a decrease of 2 percent from 1953. The decrease resulted from reduced output at underground mines and at the one tailings-reclamation plant operated by Calumet & Hecla, Inc. This loss more than offset the new production, beginning in October, from the White Pine mine of the White Pine Copper Co.

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Production from the Champion mine of the Copper Range Co. and the tailings-reclamation operation of Quincy Mining Co. was virtually the same as in 1953. Operations by these companies furnished all copper produced in Michigan.

Calumet & Hecla, Inc., fire-refines the native copper and concentrates produced from underground mines at the company smelter and refinery. Material from tailings reclamation is sent to a leaching plant, which produces copper oxide and other copper chemicals. Both smelter and refinery are near Hubbel. The Quincy Mining Co. smelts and fire-refines the concentrates from its reclamation plant and concentrate produced from ore of the Copper Range Co. Champion mine at its Hancock, Mich., smelter. White Pine Mining Co. mill, smelter, and refinery are at the mine site. However, some concentrate and some blister copper were sent to other smelters or refineries in 1955.

The average annual weighted price used to calculate the value of copper produced in 1954 was 29.5 cents per pound and does not reflect the guaranteed price paid for certain copper produced under contract with General Services Administration. In 1953 the annual weighted price used was 28.7 cents per pound.

TABLE 2.—Mine production of copper, 1945–49 (average) and 1950–54, in terms of recoverable metal

Year	Mines producing		Material treated		Copper	
	Lode	Tailings	Ore (short tons)	Tailings (short tons)	Short tons	Value
1945–49 (average)	10	3	1,852,585	2,763,376	24,706	$9,024,989
1950	9	3	2,148,919	2,237,555	25,608	10,652,928
1951	8	3	2,214,369	2,256,965	24,979	12,089,836
1952	8	3	1,879,131	1,991,051	21,699	10,502,316
1953	9	2	2,314,420	1,878,297	24,097	13,831,678
1954	13	2	2,478,085	1,812,695	23,593	13,919,870

TABLE 3.—Mine production of copper in 1954, by months, in terms of recoverable metal

Month	Short tons	Month	Short tons
January	1,678	August	1,620
February	1,619	September	2,046
March	2,151	October	2,153
April	1,857	November	2,074
May	1,866	December	2,843
June	1,976		
July	1,710	Total	23,593

The contract between the Defense Minerals Exploration Administration and Calumet & Hecla, Inc., for exploration of properties in Houghton and Keweenaw Counties continued throughout 1954. The initial contract was dated August 3, 1951, for a total of $284,096 of which the Government share was to be 50 percent.

Iron Ore.—Following the decline in steel production, iron-ore mining in Michigan was reduced substantially in 1954. The tonnage of crude iron ore mined in Michigan in 1954 was 22 percent less than

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in 1953, while ore shipments decreased 27 percent. While a small percentage is sold for use in the manufacture of iron oxide pigments, most of the iron ore is used in the manufacture of iron and steel products.

In 1954 the mine value, $70 million, of the ore shipped from the Michigan iron ranges decreased 26 percent from the 1953 total of $94.7 million. The average value at the mines of the ore without respect to grade was $7.21 per long ton in 1954 and $7.11 in 1953. The value applies more closely to the non-Bessemer grades, which constitute the bulk of the tonnage shipped. At the end of 1953 and throughout 1954 Lake Erie base prices were Mesabi non-Bessemer and High-Phosphorus $9.90 per ton, Mesabi Bessemer $10.05, Old Range non-Bessemer $10.15, Old Range Bessemer $10.30, and open-hearth lump ore $11.15. These prices were for ore delivered at lower Lake ports, carrying 51.5 percent natural iron, with 0.045 percent (max.) phosphorus (dry) for Bessemer grades; ore exceeding 0.18 percent phosphorus (dry) are classified as High-Phosphorus. Premiums and penalties are applied for variations in analyses and physical structure.

The first cargo of iron ore left Escanaba, Mich., April 19. The initial shipment from Ashland, Wis., was on April 24 and from Marquette, Mich., on April 28. Final ore cargoes left Marquette November 28 and Ashland November 16. Favorable weather during the shipping season eliminated the need for steaming ores, although the Lake Superior & Ishpeming Railroad Co. did heat ore in its thawhouse at Marquette during a spring cold wave. Escanaba, which shipped the season's final cargo December 2, did not steam any ore in 1954 although operations were continued to an unusually late date.

Manganiferous Iron Ore.—M. A. Hanna & Co. produced and shipped 15,361 tons of manganiferous iron ore from the Cannon mine in Iron County. 1953 production from the same mine was 76,251 tons.

TABLE 4.—Production, shipments, and stocks of crude iron ore in 1954, by counties and ranges, in gross tons [1]

County or range	Stocks of crude ore, Jan. 1, 1954 [2]	Production in 1954		Shipments in 1954		Stocks of crude ore, Dec. 31, 1954
		Underground	Open pit	Direct to consumers	To beneficiation plants	
County:						
Baraga			278,137		278,137	
Dickinson			53,245	53,245		
Gogebic	625,400	2,287,476	152,287	2,377,743		687,420
Iron	731,623	3,408,970	226,000	3,568,270	80,302	718,021
Marquette	1,104,442	4,238,312	564,725	3,438,818	403,566	2,065,095
	2,461,465	9,934,758	1,274,394	9,438,076	762,005	3,470,536
Range:						
Gogebic	625,400	2,287,476	152,287	2,377,743		687,420
Marquette	1,104,442	4,238,312	842,862	3,438,818	681,703	2,065,095
Menominee	731,623	3,408,970	279,245	3,621,515	80,302	718,021
	2,461,465	9,934,758	1,274,394	9,438,076	762,005	3,470,536

[1] Exclusive of iron ore containing 5 percent or more manganese.
[2] Revised figures.

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TABLE 5.—Usable iron ore shipped from mines, 1941–54, by ranges, in gross tons [1]

Year	Marquette range	Menominee range (Michigan portion)	Gogebic range (Michigan portion)	Total
1941	6,346,165	4,036,486	4,818,968	15,201,619
1942	6,540,228	4,897,305	4,691,941	16,129,474
1943	5,602,904	4,812,731	4,094,722	14,510,357
1944	4,790,179	4,835,317	4,067,881	13,693,377
1945	4,585,340	4,239,045	3,008,670	11,833,055
1946	3,270,384	2,589,433	2,617,608	8,477,425
1947	5,543,124	3,712,501	3,709,857	12,965,482
1948	4,896,754	4,085,089	3,914,635	12,896,478
1949	4,249,707	3,587,068	3,156,464	10,993,239
1950	4,958,674	4,035,347	3,827,323	12,821,344
1951	5,647,423	4,767,139	3,197,059	13,611,621
1952	4,516,509	4,258,996	3,003,861	11,779,366
1953	5,571,501	4,552,915	3,188,350	13,312,766
1954	3,675,429	3,655,995	2,377,743	9,709,167
1941–54	70,194,321	58,065,367	49,675,082	177,934,770

[1] Exclusive of iron ore containing 5 percent or more manganese, natural.

TABLE 6.—Usable iron ore produced, 1854–1950 total, and 1951–54, by ranges, in gross tons [1]

Year	Marquette range	Menominee range (Michigan portion)[2]	Gogebic range (Michigan portion)[2]	Total
1854–1950	257,273,896	215,247,074	218,416,581	690,937,551
1951	5,617,935	4,986,290	3,099,676	13,703,901
1952	4,668,550	4,168,465	2,972,930	11,809,945
1953	5,785,118	4,559,638	3,468,585	13,813,341
1954	4,670,603	3,640,320	2,439,763	10,750,686
1854–1954	278,016,102	232,601,787	230,397,535	741,015,424

[1] Exclusive of iron ore containing 5 percent or more manganese, natural.
[2] Distribution by range partly estimated before 1906.

TABLE 7.—Manganiferous iron ore (containing 5 to 10 percent manganese, natural) and ferruginous manganese ore (containing 10 to 35 percent manganese, natural) shipped from mines, 1910–40 total, and 1941–54

[Gross tons]

Year	Gross tons	Year	Gross tons
1910–40	3,120,797	1948–49	
1941		1950	105,017
1942	30,931	1951	[1] 62,166
1943	89,368	1952	19,728
1944	40,794	1953	68,081
1945	1,500	1954	13,715
1946	1,743		
1947		1910–54	3,553,840

[1] Revised figure.

NONMETALS

Cement.—Producing plants shipped 16.7 million barrels of portland cement valued at $45.7 million in 1954, an increase of 858,600 barrels (5 percent) over 1953. Production was from 7 plants (in 6 counties) with a total capacity of about 19 million barrels. The average value of portland cement shipped from Michigan was $2.73 per barrel in 1954 and $2.64 in 1953.

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Masonry cements manufactured from portland cement or cement clinker and other materials were produced at 5 plants. Four plants used cement clinker and 1 portland cement. The average value of masonry cements was $3.41 per barrel in 1954 and $3.30 in 1953.

TABLE 8.—Finished portland cement produced, shipped, and in stock, 1945–49 (average) and 1950–54

Year	Active plants	Production (barrels)	Shipments from mills			Stocks at mills on Dec. 31 (barrels)
			Barrels	Value		
				Total	Per barrel	
1945–49 (average)	8	9,984,470	10,110,698	$19,577,844	$1.94	1,172,559
1950	7	12,967,102	12,854,423	29,619,766	2.30	1,317,145
1951	7	14,393,599	14,112,639	35,121,324	2.49	1,598,105
1952	7	14,790,587	14,760,783	36,819,042	2.49	1,627,909
1953	7	15,532,853	15,853,096	41,860,464	2.64	1,307,666
1954	7	16,671,383	16,711,710	45,691,867	2.73	1,267,339

Clays.—Clays produced in 1954 weighed 1.9 million tons valued at $1.9 million, an increase of 225,000 tons and $233,100 in value over 1953. The increased production in 1954 largely resulted from the increased cement production. Of the total clay produced, 1,475,014 tons (76 percent) was used in manufacturing cement and 445,800 tons for manufacturing brick, tile, heavy clay products, refractories, and lightweight aggregates. In 1954, 11 companies operated plants in 8 counties. Production was principally from Wayne County, followed by Shiawassee, Oakland, Eaton, Monroe, Lenawee, Saginaw, and Gratiot in that order. The average value (partly estimated) of clays was $1.03 per ton in both 1953 and 1954.

Gypsum.—Michigan ranked first in the United States in the production of crude gypsum. Production in 1954 was 1.7 million tons valued at $5.0 million (from 4 companies in Kent and Iosco Counties), an increase of 246,300 tons (17 percent) and $944,500 (23 percent) in value over 1953. Calcining plants were operated at Grand Rapids in Kent County, at National City in Iosco County, and at River Rouge in Wayne County. The principal products were plasterboard, lath, exterior sheathing, and plaster. The average value of crude gypsum in 1954 was $2.97 per ton, compared with $2.83 in 1953.

Lime.—Quicklime and hydrated lime were produced by three companies from high-calcium limestones obtained from quarries in northern Michigan. Production was in Bay, Menominee, and Mason Counties for chemical and industrial use and in 1954 was nearly 1 percent less than in 1953.

Marl.—Michigan led all States in producing calcareous marl, with 106,700 tons in 1954, a decrease of almost 42 percent from 1953. The marl is dug from bogs and dried for agricultural use. Limestone, with a higher neutralizing value, has replaced marl, to some extent, for agricultural use.

Perlite.—Crude perlite, produced in Western States, was expanded at a plant in Grand Rapids for use as a lightweight aggregate in plaster and concrete.

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Salines.—Natural and artificial brines were produced from wells in Gratiot, Manistee, Mason, Midland, and LaPeer counties. Bromine and bromine compounds, calcium chloride, calcium-magnesium chloride, magnesium compounds, and potassium salts were produced from the brines in one or more of these counties. The value of these products, other than salt (see section on Salt), was $31.1 million, an increase of nearly 8 percent over 1953.

TABLE 9.—Sand and gravel, sold or used by producers, 1953–54, by classes of operations and uses

Class of operation and use	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:[1]						
Molding	1,959,807	$1,968,065	$1.00	1,117,737	$1,273,601	$1.14
Building	3,655,863	2,610,498	.71	4,710,204	3,528,755	.75
Paving	3,150,812	2,537,940	.81	3,002,364	2,365,766	.79
Grinding and polishing	241,917	84,671	.35	(2)	(2)	(2)
Engine	55,845	39,183	.70	33,424	25,798	.77
Ground	(2)	(2)	(2)	(2)	(2)	(2)
Other	196,904	97,108	.49	522,945	430,028	.82
Undistributed [3]	280,050	833,915	2.98	560,561	966,587	1.72
Total commercial sand	[1] 9,541,198	[1] 8,171,380	.86	9,947,235	8,590,535	.86
Gravel:						
Building	3,815,209	3,795,671	.99	4,131,930	4,357,628	1.05
Paving	10,253,572	8,210,413	.80	11,231,436	9,072,018	.81
Railroad ballast	506,727	349,729	.69	284,306	267,750	.94
Other	96,456	65,699	.68	374,016	213,138	.57
Total commercial gravel	14,671,964	12,421,512	.85	16,021,688	13,910,534	.87
Total commercial sand and gravel	[1] 24,213,162	[1] 20,592,892	.85	25,968,923	22,501,069	.87
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building				8,284	1,355	.16
Paving	526,827	72,546	.14	523,099	196,424	.38
Total Government-and-contractor sand	526,827	72,546	.14	531,383	197,779	.37
Gravel:						
Building	60,405	4,025	.07	788,115	373,108	.47
Paving	5,663,069	2,545,469	.45	4,752,218	2,444,213	.51
Total Government-and-contractor gravel	5,723,474	2,549,494	.45	5,540,333	2,817,321	.51
Total Government-and-contractor sand and gravel	6,250,301	2,622,040	.42	6,071,716	3,015,100	.50
ALL OPERATIONS						
Sand	[1] 10,068,025	[1] 8,243,926	.82	10,478,618	8,788,314	.84
Gravel	20,395,438	14,971,006	.73	21,562,021	16,727,855	.78
Grand total	[1] 30,463,463	[1] 23,214,932	.76	32,040,639	25,516,169	.80

[1] Includes friable sandstone; revised figures.
[2] Included with "Undistributed" to avoid disclosure of individual company operations.
[3] Includes: Glass, blast, and railroad ballast sand in 1953; glass, grinding and polishing, blast, filter, and railroad ballast sand in 1954.

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Salt.—Salt was produced from natural and artificial well brines in Gratiot, Manistee, Midland, Muskegan, St. Clare, and Wayne Counties. Much of the production was used in manufacturing numerous chemicals and in industry. One underground mine in Wayne County produced rock salt in various sizes and grades. Table salt and stock feed also were important outlets. One new operation, that of the Hooker Electrochemical Co., began at Montague in Muskegan County. The company produced chlorine and caustic soda from artificial brines. Ten companies operated 11 plants during 1954. Production in 1954 was 5.1 million tons, a 1-percent decrease compared with 1953. The total value increased sharply because of a higher and more realistic value applied to brines used for manufacturing chemicals. Salt in brines sold and used for this purpose was about 61 percent of the total production.

Sand and Gravel.—Sand and gravel was produced in nearly every Michigan county (77 of 83) in 1954. Production increased 5 percent in quantity and nearly 10 percent in value over 1953. As a large share of the output was used in building and road-construction industries, production tended to be concentrated around centers of population. Counties surrounding the Detroit area (Grand Rapids and Lansing) reported substantial values. Table 9 shows the production of sand and gravel, by uses and type of operation, for 1953 and 1954. The 10 largest commercial producers were: American Aggregates Corp., Greenville, Ohio; Dachille Trucking Co., Great Lakes Foundry Sand Co., and Koenig Coal & Supply Co., all of Detroit; Foley & Beardslee, Clarkston; Grand Rapids Gravel Co., Grand Rapids; Michigan Silica Co., Rockwood; Harry Pickitt, Allegan; Southern Michigan Materials Co., Ohio; and Whittaker & Gooding Co., Ypsilanti.

Stone.—Limestone and dolomite, sandstone, and a small quantity of miscellaneous stone were produced in 1954. Limestone and dolomite contributed the greatest tonnage and value. A small quantity of dimension limestone was produced, but the major production was as crushed and broken stone. Principal uses of crushed limestone were fluxing, 42 percent; concrete aggregate and roadstone, 21 percent; and various chemical and industrial uses, including the manufacture of cement and lime, 34 percent. The production of limestone and dolomite in 1954 was 27.7 million tons valued at $21.8 million, an increase of 29 percent in quantity and 24 percent in value over 1953. The figures, however, are not strictly comparable. Before 1954, limestone used in manufacturing cement and lime was not included, because its quantity and value would be reflected in the quantity and value of the cement and lime produced. In 1954 data, limestone for cement and lime is included, and the State total value of mineral production is adjusted to eliminate the duplication of value. The principal producers of limestone, in order of value in 1954, were: Michigan Limestone Division, United States Steel Corp., Presque Isle County; Inland Lime & Stone Co. Division, Inland Steel Co., Schoolcraft County; Drummond Dolomite, Inc., Chippewa County; Wyandotte Chemicals Corp., Alpena County; France Stone Co., Monroe County; Wallace Stone Co., Huron County; Michigan Stone Co., Monroe County; Petoskey Portland

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Cement Co., Emmet County; Michigan Foundation Quarry Co., operated by Edward Kraemer & Sons, Wayne County; and F. G. Cheney Limestone Co., Eaton County.

Dimension sandstone used in construction was produced by two companies in Jackson County. The quantity reported was considerably greater than in 1953. Some ground sandstone, tabulated as sand, for abrasive, foundry, and other uses, was produced in Wayne County.

TABLE 10.—Dimension stone sold or used by producers, 1950–54, by kinds

Year	Limestone		Sandstone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1950	4,430	$43,019			4,430	$43,019
1951	4,627	43,138	984	$4,776	5,611	47,914
1952	5,322	45,925	908	5,126	6,230	51,051
1953	4,849	53,425	369	2,624	5,218	56,049
1954	8,938	68,984	3,524	31,235	12,462	100,219

TABLE 11.—Crushed and broken stone sold or used by producers, 1953–54, by uses

Use	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Limestone:						
Riprap:						
Commercial	5,347	$9,959	$1.86	38,134	$22,549	$0.59
Noncommercial	64,715	89,658	1.39			
Fluxing	12,746,549	9,780,588	.77	10,815,128	9,032,464	.84
Concrete aggregate, roadstone:						
Commercial	3,575,506	3,646,897	1.02	4,050,770	4,318,101	1.07
Noncommercial	38,823	46,588	1.20	227,725	249,502	1.10
Railroad ballast	124,580	151,136	1.21	114,916	143,618	1.25
Agriculture	624,922	587,623	.94	534,306	485,252	.91
Other uses	4,315,678	3,118,035	.72	11,883,295	7,444,694	.63
Total commercial	21,392,582	17,294,238	.81	27,436,549	21,446,678	.78
Total noncommercial	103,538	136,246	1.32	227,725	249,502	1.10
Total limestone	21,496,120	17,430,484	.81	27,664,274	21,696,180	.78
Granite,[1] basalt,[1] sandstone, and miscellaneous stone:						
Concrete aggregate, roadstone:						
Commercial	63,038	90,406	1.43	44,828	79,250	1.77
Noncommercial	51,310	62,586	1.22	36,879	28,868	.78
Total granite, basalt, sandstone, and miscellaneous stone	114,348	152,992	1.34	81,707	108,118	1.32
Total commercial	21,455,620	17,384,644	.81	27,481,377	21,525,928	.78
Total noncommercial	154,848	198,832	1.28	264,604	278,370	1.05
Grand total	21,610,468	17,583,476	.81	27,745,981	21,804,298	.79

[1] 1953 only.

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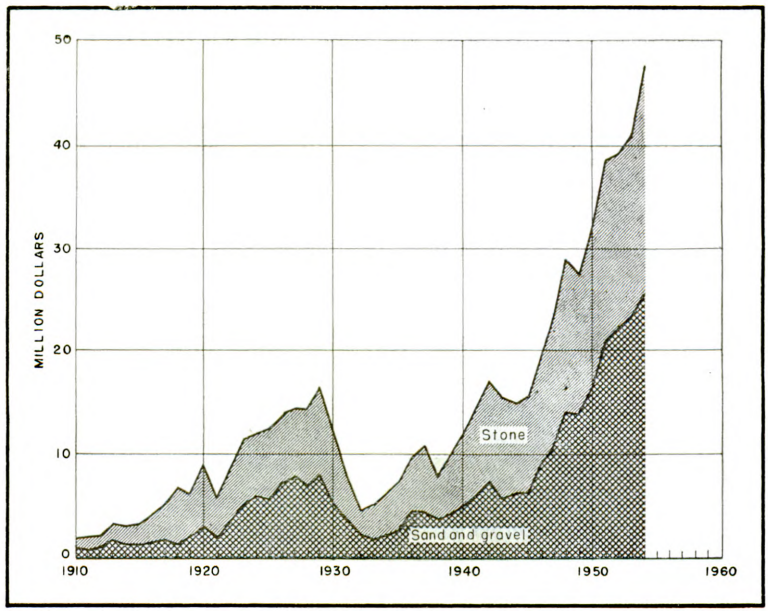

FIGURE 2.—Value of sand and gravel and stone in Michigan, 1910–54.

MINERAL FUELS

Natural Gas.[2]—Production of natural gas decreased 3 percent in value below 1953. Nearly 32 percent of the production was from oil-well gas, the remainder being from 301 wells in 21 counties. Clare, Crawford, and Isabella Counties provided 55 percent of the total production. Eight new producing wells were completed during the year. The production of natural gasoline and natural-gas liquids from oil-well gas decreased 9 percent in volume and 6 percent in value below 1953. Production in Crawford County furnished 75 percent of the total.

Peat.—Peat was produced in Kalamazoo, Mason, and St. Clair Counties. Although classed as a fuel, the entire production was used as a soil conditioner, marketed as moss and reed or sedge peat. Production in 1954 was 27,800 tons, an increase of 9 percent over 1953. Value increased 67 percent.

Petroleum.—Production of petroleum [3] decreased about 1 percent in both quantity and value below 1953. At the close of the year 4,174 wells were producing. During the year 221 new producing wells were completed. Of these, 197 were field wells and 22 new discoveries. Production was reported in 37 counties, the major portion (36 percent) being from Arenac, Isabella, and Clare Counties. Virtually all of the petroleum produced in Michigan was refined within the State. Fourteen refineries were operated in 9 counties. The combined daily capacity is approximately 137,500 barrels; about one-third of the crude oil processed is of Michigan origin.

[2] Data, except for production, from Summary Operations Oil and Gas Fields, 1954, Michigan Department of Conservation, Geological Survey Division, Lansing, 1955, 28 pp.
[3] Work cited in footnote 2.

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REVIEW BY COUNTIES

Alcona.—E. P. Brady & Co., Flint, and the county road commission produced sand and gravel for road construction. The State highway department contracted for road gravel.

Alger.—E. P. Brady & Co., Flint, produced gravel for highway construction from the Sayre Ostrander pit near Grand Marais and from the Hilma Samuelson pit near Chatham. Leonard Johnson (Chatham), Duluth South Shore & Atlantic Railroad, and the county road commission produced sand and gravel for use as engine sand, for building, and for road construction.

Allegan.—L. Z. Arndt, Fennville, and Gerald Arnsman and Emil Pavlak, Hopkins, produced marl for agricultural use. Sand and gravel for building and road construction was produced by Cleo L. Arndt and Vernon & Son, Fennville; Ralph W. Bodine, Otsego; Huitt & Son, Harry Pickitt, and Ben Waanders, Allegan; West Shore Construction Co., Zeeland, from pits near Dunningville and Grand Junction; and John G. Yerington, Benton Harbor. Petroleum and natural gas were produced.

TABLE 12.—Value of minerals produced in Michigan, 1953–54, by counties [1]

County	1953 [2]	1954	Minerals produced in 1954 in order of value
Alcona	$77,055	$38,437	Sand and gravel.
Alger	37,213	50,000	Do.
Allegan	1,112,133	881,892	Petroleum, sand and gravel, marl.
Alpena	19,793,599	21,680,563	Cement, stone, sand and gravel.
Antrim	(3)	59,915	Sand and gravel, stone.
Arenac	6,044,231	5,695,058	Petroleum, stone, sand and gravel.
Baraga	889,242	618,149	Iron ore, sand and gravel.
Barry	162,857	287,256	Sand and gravel, petroleum, marl.
Bay	6,414,183	6,813,760	Cement, petroleum, lime, clays.
Benzie	18,600	15,600	Sand and gravel.
Berrien	283,780	452,106	Sand and gravel, petroleum.
Branch	98,495	95,712	Sand and gravel, marl.
Calhoun	352,725	264,291	Do.
Cass	102,066	100,971	Sand and gravel, marl, petroleum.
Charlevoix	53,046	72,320	Sand and gravel.
Cheboygan	(3)	45,639	Sand and gravel, stone.
Chippewa	3,103,029	2,922,200	Stone, sand and gravel.
Clare	1,896,747	3,167,458	Petroleum.
Clinton	230,646	260,604	Sand and gravel.
Crawford	879,698	852,599	Petroleum, sand and gravel.
Delta	157,418	115,377	Sand and gravel.
Dickinson	316,587	435,540	Iron ore, sand and gravel, stone.
Eaton	311,703	369,410	Sand and gravel, stone, clays.
Emmet	(3)	3,948,008	Cement, stone, sand and gravel.
Genesee	357,120	773,648	Sand and gravel, petroleum.
Gladwin	1,613,344	1,399,928	Petroleum.
Gogebic	22,437,191	16,454,125	Iron ore, sand and gravel.
Grand Traverse	(3)	(3)	Sand and gravel.
Gratiot	3,241,088	3,550,590	Salines, salt, petroleum, sand and gravel, clays.
Hillsdale	176,175	537,228	Sand and gravel, marl.
Houghton [4]	13,887,177	13,949,082	Copper, stone, sand and gravel.
Huron	752,331	657,404	Stone, sand and gravel, petroleum.
Ingham	88,305	582,539	Sand and gravel.
Ionia	281,717	141,051	Sand and gravel, petroleum.
Iosco	(3)	4,065,776	Gypsum, stone, sand and gravel.
Iron	32,122,653	25,626,888	Iron ore, manganiferous ore, sand and gravel.
Isabella	4,477,209	4,230,054	Petroleum, sand and gravel.
Jackson	457,887	387,721	Sand and gravel, stone, marl.
Kalamazoo	635,359	553,865	Sand and gravel, marl, peat, petroleum.
Kalkaska	371,953	231,180	Petroleum, sand and gravel.
Kent	2,548,048	2,978,385	Sand and gravel, gypsum, petroleum, marl.
Lake	131,147	79,045	Sand and gravel, petroleum.
Lapeer	(3)	375,315	Sand and gravel, salines.
Leelanau	22,797	27,634	Sand and gravel.
Lenawee	3,428,062	3,570,225	Cement, sand and gravel, clays.
Livingston	(3)	2,644,363	Sand and gravel.
Luce	(3)	125,416	Do.

See footnotes at end of table.

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TABLE 12.—Value of minerals produced in Michigan, 1953–54, by counties[1]—Continued

County	1953 [2]	1954	Minerals produced in 1954 in order of value
Mackinac	$30,178	$121,479	Sand and gravel, stone.
Macomb	1,014,312	1,131,612	Sand and gravel.
Manistee	7,780,243	7,412,527	Salt, salines, sand and gravel.
Marquette	40,047,678	27,660,460	Iron ore, sand and gravel, stone.
Mason	2,153,099	4,251,652	Salines, petroleum, lime, sand and gravel, peat.
Mecosta	653,917	593,914	Petroleum, sand and gravel, marl.
Menominee	(3)	800,329	Lime, sand and gravel.
Midland	23,341,171	25,911,289	Salines, petroleum, salt, sand and gravel.
Missaukee	1,879,385	1,792,161	Petroleum, sand and gravel, marl.
Monroe	800,049	1,141,128	Stone, petroleum, sand and gravel, clays.
Montcalm	1,034,021	1,005,628	Petroleum, sand and gravel.
Montmorency	(3)	15,484	Sand and gravel.
Muskegon	1,043,241	862,605	Sand and gravel, petroleum, salt.
Newaygo	994,660	728,109	Petroleum, sand and gravel.
Oakland	4,507,606	5,187,124	Sand and gravel, clays, petroleum.
Oceana	3,051,264	2,655,812	Petroleum, sand and gravel, marl.
Ogemaw	2,467,158	2,560,245	Petroleum, sand and gravel.
Osceola	2,340,062	2,337,077	Do.
Oscoda	(3)	15,443	Sand and gravel, petroleum.
Otsego	37,361	33,485	Sand and gravel.
Ottawa	1,922,061	649,784	Petroleum, sand and gravel, marl.
Presque Isle	8,358,698	10,703,716	Stone, sand and gravel.
Roscommon	1,370,531	1,210,450	Petroleum.
Saginaw	104,484	89,847	Clays, petroleum.
St. Clair	8,693,879	10,376,032	Salt, cement, peat, sand and gravel.
St. Joseph	164,564	192,338	Sand and gravel, marl.
Sanilac	89,175	118,512	Sand and gravel.
Schoolcraft	(3)	3,674,222	Stone, sand and gravel.
Shiawassee	246,182	160,959	Sand and gravel, clays.
Tuscola	1,134,183	1,021,205	Sand and gravel, petroleum.
Van Buren	709,962	353,544	Petroleum, sand and gravel.
Washtenaw	1,084,392	1,840,497	Sand and gravel, petroleum.
Wayne	22,759,490	28,939,571	Salt, cement, sand and gravel, stone, clays.
Wexford	(3)	(3)	Sand and gravel.
Undistributed [5]	17,309,213	2,417,433	
Total	286,487,000	280,150,000	

[1] Except for natural gas, natural-gas liquids.
[2] Revised.
[3] Included with "Undistributed."
[4] Includes value of mineral production in Keweenaw and Ontonagon counties.
[5] Includes value of mineral production that the Bureau of Mines is not at liberty to publish and principal minerals produced as indicated in footnote 3.

Alpena.—Wyandotte Chemicals Corp. of Wyandotte produced crushed limestone for manufacturing alkali, cement, and concrete aggregate. The Huron Portland Cement Co. at Alpena produced portland and masonry cement. The company completed a second expansion program in 1954. The first program from 1946 to 1950 established the plant as the largest single production unit in the industry. The second program (1953–54) increased capacity about 25 percent or equivalent to about one average-size American cement plant. The total increase since 1946 is estimated at about 150 percent. At the end of 1954 the plant, with 24 rotary kilns, had a rated annual capacity of 9 million barrels of finished portland cement. E. P. Brady & Co., Flint, produced gravel from pits in Herron Township for road construction.

Antrim.—Northland Construction Co., Petoskey, and the county road commission produced sand and gravel for road construction. Antrim County Road Commission produced miscellaneous stone for road construction.

Arenac.—The Arenac County Road Commission produced limestone for use as riprap. Sand and gravel for building use and road construction was produced by Deep River Block & Sand Co., Eastman

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Gravel Pit, and Van Deusen Sand & Stone, all of Standish. The county ranked first (16 percent) in the production of petroleum.

Baraga.—The Cleveland-Cliffs Iron Co. mined iron ore and operated the concentrator at the Ohio mine.

The county road commission produced sand and gravel for highway use, and the State highway department contracted for road gravel.

Barry.—H. A. Carlton Schau, Kalamazoo, produced marl for agricultural use.

Cole Gravel Co. (Dorr), Nashville Gravel Co. and Pennock Concrete Products (Nashville), Harry Pickitt (Allegan), Steenbock Gravel Co. (Hastings), John G. Yerington (Benton Harbor), and the county road commission produced sand and gravel for building and road construction. Petroleum was produced.

Bay.—The Aetna Portland Cement Co. at Bay City produced portland and masonry cements. A new kiln was installed, increasing the number in operation to four. Accessory equipment also was installed, increasing the rated annual capacity considerably. Clay was produced locally by the Aetna Portland Cement Co. The county ranked seventh (5 percent) in the production of petroleum.

Benzie.—The county road commission produced road gravel.

Berrien.—Ireland & Lester Co. (St. Joseph), Kiell Trucking and Nieb Concrete Products (Niles), Fred M. Ott (Bridgman), Producers Core Sand Corp. (Michigan City, Ind., at Sawyer), Wakerman & Neva Ryno (Coloma), and John G. Yerington (Benton Harbor) produced molding sand and sand and gravel for building and highway construction. Contracts for sand and gravel were placed by the State highway department and the St. Joseph County, Inc., Highway Department. Petroleum was produced.

Branch.—H. Stukey (Coldwater), and the county road commission produced sand and gravel. Producers of marl for agricultural use were Case Bros., Sherwood, operating the Dunn and Himbaugh pits and Kenneth Wood, Colon.

Calhoun.—Producers of marl for agricultural use were Carl Avery, Athens, operating the Pullman pit; Case Bros., Sherwood, operating the Edward Casey, Arthur Casey, and Spoor pits; and Clyde M. Reed, Union City. Battle Creek Gravel Co. (Battle Creek), Emil Combs Gravel (Tekonsha), Harry Pickitt (Allegan at Battle Creek), John G. Yerington (of Benton Harbor at Marshall and Albion), and the city of Battle Creek produced sand and gravel for building and road construction.

Cass.—Marl for agricultural use was produced by Grant Brizendine, Edwardsburg, operating the Thulin pit, and Frank R. Hixon, Marcellus. Heide's Sand & Gravel of Niles produced sand and gravel for building and road use. Gravel for highway construction was produced by Harry Pickitt of Allegan at Dowagiae; John G. Yerington of Benton Harbor in LaGrange Township; and the county road commission. Petroleum was produced.

Charlevoix.—Sand and gravel for highway construction was produced by Harry Pickitt, Allegan, and the county road commission. The State highway department contracted for sand and gravel.

Cheboygan.—Crushed limestone for riprap was produced by the Afton Stone & Lime Co., Afton. Hugh M. Mason, Gaylord, operated

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a sand and gravel pit near Vanderbilt. Tabor Co., Grand Rapids, produced road gravel from a pit near Wolverine.

Chippewa.—Limestone produced by the Drummond Dolomite, Inc., Sheboygan, Wis., was sold for flux, agricultural, chemical, industrial, concrete aggregate, and other uses. I. L. Whitehead Co., Sault Ste. Marie, produced gravel for building and road purposes. Fox Valley Construction Co., Appleton, Wis., mined road gravel from a pit near Sault Ste. Marie. The county road commission produced road gravel, and the State highway department contracted for sand and gravel.

Clare.—Clare County ranked first in the production of natural gas (27 percent) and third in the production of petroleum (9 percent).

Clinton.—Boichot Concrete Products Corp. (Lansing), Harry Pickitt (Allegan), Walling Gravel Co. (St. Johns), and the county road commission produced sand and gravel for use in building and road construction.

Crawford.—Crawford County ranked first in the production of natural gasoline (75 percent) and second in the production of natural gas (15 percent). Petroleum also was produced. Tabor Co., Grand Rapids, produced road gravel from the Bruun pit near Grayling. The county road commission produced gravel for road construction.

Delta.—Bichler Bros. (Escanaba), Cloverland Milling-Supply Co. and Days River Sand & Gravel Co. (Gladstone), and Van Enkevorts Bros. (Bark River) produced sand and gravel for building use. The county road commission produced road gravel.

Dickinson.—The Globe Iron Co. operated the Globe-Cornell mine, and Jackson Iron & Steel Co. operated the Bradley mine. Both are open-pit operations. Champion Inc., Iron Mountain, produced sand and gravel for railroad ballast and building and highway construction from plants in Loretto, Menominee, and Iron Mountain. The county road commission produced road gravel. Superior Rock Products Co., Sagola, and Metro-Nite Co., Milwaukee, produced limestone for use as a concrete aggregate and for filter plants.

Eaton.—Clay for the manufacture of heavy clay products, vitrified pipe, and tile was produced by Grand Ledge Clay Products Co., Grand Ledge. Limestone was produced by the F. G. Cheney Limestone Co., Bellevue, for use as rubble and concrete aggregate and for agricultural purposes. Sand and gravel was produced by A. L. Dyer & Sons of McBrides at Charlotte, Harry Pickitt of Allegan at Vermontville, and Pryor Bros. at Charlotte.

Emmet.—Petoskey Portland Cement Co. produced portland cement and limestone for use as an asphalt filler and for manufacturing cement at Petoskey. Northland Construction Co., Petoskey, and William Perry & Son, Harbor Springs, produced sand and gravel for building and road use.

Genesee.—Filter sand and sand and gravel for building and road construction were produced by E. P. Brady & Co., of Flint, at Linden; R. L. Ferguson Excavating Co. and A. S. Leffler Gravel Co., Davison; Hansen Gravel Co., Flushing; Kurtz Gravel Co. and Otisville Stone Co., Flint; Mathews Gravel Co., Mount Morris; John Post & Sons Aggregate Supply Co., Swartz Creek; Saginaw Core Sand Co. of Saginaw, Otisville; and Justus Snelenberger, Burt. Petroleum was produced.

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Gladwin.—Gladwin County ranked 10th (4 percent) in the production of petroleum.

Gogebic.—About 24 percent of the State 1954 iron-ore output was from mines in Gogebic County. Production and shipments of iron ore were reported by M. A. Hanna & Co., operating the Wakefield mine; Oliver Iron Mining Division, United States Steel Corp., operating the Geneva mine; Pickands Mather & Co., operating the Anvil-Palms-Keweenaw, Loomis, Newport, Peterson and Sunday Lake mines; and Republic Steel Corp., operating the Penokee group. Ironwood Concrete Products Co. and Lake Superior Gravel Co. (Ironwood), Emil Piispanen (Bessemer), and the county road commission produced building and paving sand and gravel.

Grand Traverse.—Paul C. Miller (Sparta) and Peninsula Asphalt & Construction Co. (Grand Traverse) produced sand and gravel for road construction.

Gratiot.—The Michigan Chemical Corp. produced bromine and bromine compounds, calcium-magnesium chloride, magnesium compounds, and salt from natural well brines from the Marshall and Dundee formations at St. Louis. Salt, recovered from the brines by evaporation, was used for table salt, various chemical and industrial purposes, and stock feed. Clay Products Co., St. Louis, produced clay for manufacturing heavy clay products. Roy Dayringer and North Star Gravel Co. (both of Ithaca), A. L. Dyer & Sons (McBrides), Tabor Co. (Grand Rapids), and the county road commission produced sand and gravel for building and road construction. Petroleum and natural gas were produced.

Hillsdale.—Virgil Kintigh, Jonesville, produced marl for agricultural use. Sand and gravel for building and road construction was produced by Bundy Hill Gravel Co., Somerset Center; Elliott Ice & Coal Co. and Art Russell Concrete Products, both of Hillsdale; Hoover Gravel Pit, Waldron; Northwest Materials, Inc., and Southern Michigan Materials, Inc., both of Byran, Ohio, which operated pits near Ransom; and the county road commission. The State highway department contracted for road gravel.

Houghton.—Houghton County ranked second in the production of copper. Calumet & Hecla, Inc., operated the Centennial, North Kearsarge, and Osceola Lode mines and the Tamarack reclamation plant. Extracts from the Calumet & Hecla, Inc., annual report for 1954 follow:

> The major project underway at the Calumet Division during the year was the unwatering of the Osceola lode. All surface construction was completed in the fall, ahead of schedule, but the mine rehabilitation phase remained behind schedule. This was principally due to difficulties encountered in rehabilitation of No. 6 Osceola shaft, where extreme cave-ins had occurred. This additional work made it impossible to regain time lost during the 1952 strike and the poor weather conditions of the 1952–1953 winter.
>
> At year's end the water had been lowered 2,020 feet vertically, which constitutes about 70% of the total water to be pumped.

1. The average grade of ore from seven operating mines was 16.96 pounds per ton, somewhat under the figure for the previous year. Total production was also slightly lower. This was a reflection of the fact that commercial reserves are close to being exhausted in several of the mines. Closing of these declining properties should coincide with opening of the Osceola shafts, where full production of 3,000 tons of ore per day will maintain present levels.

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2. Production of copper at the Tamarack Reclamation Plant remained satisfactory, though total poundage reclaimed was lower than the previous year. It is anticipated that operations at the plant will continue for a number of years, with dredging scheduled to begin in tailings from the Ahmeek bank when the present location is exhausted.

Copper Range Co. operated the Champion mine and the Freda concentrator. Concentrates were refined by the Quincy Mining Co. at Hancock. Extracts from the Quincy Mining Co. annual report for 1954 follow:

Mining operations at the Champion Mine proceeded without interruption during the year and resulted in shipment of 336,741 tons of copper rock to the mill. The program of development and stope preparation continued to maintain a balanced position in ore reserves above the 14th level. Maintenance and repair of mine facilities were again emphasized and have resulted in increased tonnage processed, decreased equipment failure and improved plant appearance. Copper content of the ore decreased due to completion of stoping in the 14th level North high grade zone and to the lower grade rock produced from development and stope preparation.

Repair on No. 3 shaft was more substantial than anticipated due to ground movement below the 6th level. This work was completed to the 14th level with all hoisting and crushing facilities installed preparatory to hoisting rock when timber repair is completed to the 16th level. Repair of residential houses at the various locations was completed during the year and considerable work was required on the water supply systems at Beacon Hill and Painesdale.

The concentration of copper rock was continuous during the year at Freda Mill with 336,792 tons of ore processed.

The Mine Maintenance Contract with General Services Administration was in effect during the year and 3,186,000 pounds of copper was delivered on schedule. This contract terminates on January 1, 1956 and upon delivery of 3,186,000 pounds of copper during 1955. Copper produced above the contract quota was made available to our Hussey Division. The Quincy Mining Company continued to refine concentrates produced at Freda Mill and act as shipping agents for copper produced.

Employment was slightly above the 1953 average due to the extra maintenance program. Negotiations were consummated with the United Steelworkers CIO, effective July 1, 1954, covering paid holidays and company-employee contributory group insurance plan. Labor relations have been satisfactory and assisted in the increased tonnage and beneficial work accomplished during the year.

Quincy Mining Co. operated its reclamation plant on Torch Lake and the smelter at Hancock. Extracts from the company annual report for 1954 follow:

Operation of our Reclamation Plant during 1954 has continued on about the same basis as in previous years. The plant handled a total of 917,895 tons of stamp sands, slightly more than during 1953. The slightly reduced production, when compared with the average production of prior years, and also the lower copper content in the sands from our No. 2 stamp sands as well as in the sands available for treatment in our No. 1 stamp sands, where the operations, as mentioned in our previous report have reached the cleaning up stage. The average copper content remaining in the waste sands, after treatment, was 1.83 pounds per ton which is slightly less than during the previous two years. Considering the character of the sands handled this result is very satisfactory and shows that the plant operated with good efficiency during the past year. Operations as in previous years were carried on continuously twenty-four hours per day, the only shut down being for two holidays and such periods as were required for repairs and renewals in order to keep the machinery and equipment in good operating condition.

A year ago, when the dredge returned for cleaning up operations at our No. 1 sands, it was thought that this operation could be completed by October, but when the dredge returned to the No. 2 sands late in October because of it being difficult to properly protect the dredge at No. 1 location during the stormy winter months, there were still sands available for treatment, which means more copper and a longer life than was expected; therefore, it now seems probable that

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there are sufficient sands available in our No. 1 and No. 2 locations to last 5 years. Since late October 1954 all of our dredging operations have been at our No. 2 location.

At the smelter No. 5 furnace has operated very satisfactorily during the year. Due to the quantity of custom copper available the furnace has been in continuous operation; therefore, the cost of smelting our copper has been on a very satisfactory basis.

Miscellaneous stone was produced by the Houghton County Road Commission for use in road construction. Copper Range Railroad produced engine sand, and the Duluth South Shore & Atlantic Railroad mined sand for railroad ballast. The State highway department contracted for sand and gravel.

Huron.—Limestone for use as rough and finished architectural and building stone and crushed limestone for riprap, flux, concrete aggregate and roadstone, railroad ballast, and agricultural use were produced by the Wallace Stone Co. at Bayport. E. P. Brady & Co., Flint, mined road gravel near Bayport. Wagner Sand & Gravel, Harbor Beach, produced sand for building and road construction. The county road commission produced sand and gravel, and the State highway department contracted for road gravel. Petroleum was produced.

Ingham.—Sand and gravel for use in filters, building, railroad ballast, and highway construction was produced by Angell Construction Co. (East Lansing), Cheney Gravel Co. and Delhi Gravel Co. (both of Holt), S. E. Ketchum & Sons (Mason), Harry Pickitt, (Allegan) from a pit near Mason, and Ray Sablain, Inc., and West Lansing Gravel Co. (both of Lansing). The city of Lansing and the county road commission produced sand and gravel for highway construction. The road commissions of Eaton and Ingham County contracted for the production of gravel.

Ionia.—H. L. Martin Gravel Co., Westphalia, produced sand and gravel in Lyons Township. Road gravel was produced near Ionia by Harry Pickitt, Allegan, and by the county road commission. Petroleum was produced.

Iosco.—Mineral commodities produced in the county were gypsum, limestone, and sand and gravel. Crude gypsum was produced by the National Gypsum Co. of Buffalo, N. Y., at National City and the United States Gypsum Co., of Chicago, Ill., at Alabaster. National Gypsum Co. also operated a calcining and board plant that produced wallboard, lath, exterior sheathing, and various prepared plasters. Limestone was produced by the Iosco County Highway Commission for road construction. Harry Pickitt, Allegan, produced gravel from a pit near Greenbush for road construction.

Iron.—Iron County ranked second in the production of iron ore and manganiferous iron ores in Michigan. The Hanna Coal & Ore Corp. operated the Hiawatha No. 1 and 2, Homer-Cardiff Minckler, Wauseca, and Cannon mines. Production through the new shaft at the Cannon mine was made for the first time in 1954. Pickands Mather & Co. operated the Buck, James, and Lawrence mines and the Fortune Lake open pit. Republic Steel Corp. operated the Tobin-Columbia-Monongahela mine. Inland Steel Co. operated the Bristol, Cayia, and Sherwood mines. North Range Mining Co. operated the Book and Warner mines, and the Cleveland-Cliffs Iron Co. operated the Spies mine. Champion, Inc., Iron Mountain, and the county road

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commission produced gravel. The county and State highway departments contracted for sand and gravel.

Isabella.—Isabella County ranked second in the State in production of petroleum (12 percent) and natural gasoline (11 percent) and third in the production of natural gas (13 percent). George Hubscher & Son, Mount Pleasant, mined sand and gravel near Clare. C. E. Utterback, Mount Pleasant, produced road gravel.

Jackson.—Marl for agricultural use was produced by Barns & Van Antwerp, Houston. John C. Jeffrey, Parma, produced crushed limestone for concrete aggregate and agricultural use. Ray's stone quarry, Napoleon, produced sandstone for use as rubble, rough construction, and flagging. The Star Sandstone Co. produced sandstone for use as rough and dressed architectural stone and flagging. The company also produced ground sandstone for foundry use. W. A. Cecil & Son (Concord), Klumpp Bros. Gravel Co. (Grais Lake), Palmer Sand & Gravel, Kay Robinson Contractor, Gordon D. Stevick (all of Jackson), and the county road commission produced sand and gravel for building and road construction.

Kalamazoo.—Marl for agricultural use was produced by Lawrence Hayward (Scotts), Claude Mastin and Alvin Roe (both of Climax), and Dan Slack (Kalamazoo). Cravens Peat Moss, Kalamazoo, produced peat, which was used for agricultural purposes. American Aggregates Corp. (Greenville, Ohio), Gravel Producers, Inc., and Casper Hass Co. (both of Kalamazoo), Harry Pickitt (Allegan), and John G. Yerington (Benton Harbor) produced sand and gravel for building and road construction. The city of Kalamazoo and the State highway commission contracted for road gravel. Petroleum was produced.

Kalkaska.—Paul C. Miller, Sparta, and the county road commission produced road gravel. Petroleum and natural gas were produced.

Kent.—Two companies produced crude gypsum in Kent County—the Certain-teed Products Corp., Ardmore, Pa., and the Grand Rapids Plaster Co., Grand Rapids. Both companies also operate calcining and board plants that produce wallboard, lath, exterior sheathing, and prepared plasters. Marl for agricultural use was produced by Harry H. Olthouse, Caledonia. The county ranks fifth in the production of sand and gravel with over 1.5 million tons produced in 1954. Principal producers were Grand Rapids Gravel Co. (with three plants in operation), Pekaar & Van Doorn, Harry Pickitt, H. F. Postma Gravel Co., Riverside Sand & Gravel Co., Harry Zeeff Gravel Co., Inc., and the Kent County Road Commission. Although some molding and filter sand was produced, the bulk of production was used for building and road construction. Gregg Products Co. expanded crude perlite, produced in Western States, for use as lightweight aggregate and as a plaster admixture. Petroleum and natural gas were produced.

Keweenaw.—Keweenaw County ranked first in the production of copper. Calumet & Hecla, Inc., operated the Ahmeek, Allouez, Douglas-Houghton Conglomerate, Douglas-Kearsarge, Iroquois, Peninsula-Kearsarge, and Seneca mines and the Ahmeek mill. For extracts from the company annual report, see Houghton County.

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Lake.—Petroleum and sand and gravel were produced. The Tabor Co., Grand Rapids, produced road gravel from the Latin pit near Chase. The county road commission produced sand and gravel.

LaPeer.—The Wilkenson Chemical Co., Mayville, produced calcium magnesium chloride. Pine Sand & Gravel, LaPeer, produced sand and gravel for building use. The LaPeer County Road Commission and Sanilac County mined sand and gravel for highway use.

Leelanau.—Sand and gravel was produced for the county road commission and the Michigan State Highway Department.

Lenawee.—Portland and masonry cements were produced by the Consolidated Cement Corp. at Cement City. Clay for the manufacture of heavy clay products was produced by Comfort Brick & Tile Co., Tecumseh. Sand and gravel for building and road construction was produced by Don Bills, Hudson; Donald F. Clark and O. E. Gooding & Co., Morenci; King Sand & Gravel Co., of Archbold, Ohio, from a pit near Brooklyn; Cyril Page, Manitou Beach; W. G. Porter Sand & Gravel Co. and Tecumseh Gravel Co., Tecumseh; Stamm Bros. Gravel Co. and John Woerner, Adrian; and the county road commission.

Livingston.—Sand and gravel was produced for road construction by American Aggregates Corp. (Greenville, Ohio) from a pit near Brighton, D. & J. Gravel Co. (Fowlerville), Van E. Dailey (Howell), and Paul C. Miller (Sparta).

Luce.—Gravel for building and road construction was produced by E. P. Brady & Co. (Flint) at Newberry, I. L. Whitehead (Sault Ste. Marie), and the county road commission.

Mackinac.—Fiborn Limestone Co., Sault Ste. Marie, Ontario, Canada, produced limestone for concrete aggregate. Lawrence Tamlyn (St. Ignace), I. L. Whitehead Co. (Sault Ste. Marie), and the Duluth South Shore & Atlantic Railway produced sand and gravel for road use and railroad ballast.

Macomb.—Over 1.5 million tons of sand and gravel was produced in Macomb County. Nearly two-thirds of the output was used in building construction and the balance for highways. Producers were Advance Building Materials Co., Great Lakes Gravel Co., Inc., Macomb Sand & Gravel Co., Michigan Sand & Gravel, Morgan Sand & Gravel Co., and Underwood Sand & Gravel Co., all of Utica; Maertens Sand & Gravel Co., Grosse Pointe; Louis Marsack & Sons, St. Clair Shores; and the county road commission.

Manistee.—Elemental bromine, bromine compounds, magnesium compounds, salt, and sand and gravel were the mineral products of Manistee County. The Morton Salt Co. plant at Manistee produced bromine compounds, magnesium compounds, and evaporated salt. Great Lakes Chemical Co., Filer City, and the Michigan Chemical Corp., St. Louis, produced elemental bromine from well brines at Filer City and Eastlake, respectively. Standard Lime & Stone Co. produced refractory magnesia at Manistee. Salt from well brines was produced by the Manistee Salt Works, Manistee. Frank L. Gauthier, Onekama, produced sand and gravel for building and road use. Sand Products Corp., Detroit, produced molding and grinding sand at Manistee. The county road commission produced road gravel.

Marquette.—Marquette County ranked first in the State in production of iron ore. The Cleveland-Cliffs Iron Co. operated the

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Bunker Hill, Cambria-Jackson, Cliffs Shaft, Lloyd, Maas, and Mather underground mines and the Humbolt and Tilden open-pit mines. The Humbolt mine began production of concentrate by flotation from low-grade ore (jasper and specular hematite) and made its initial shipment in 1954—the first shipment of jasper concentrate from any Michigan mine. Completion of a larger plant to concentrate similar ore at the Republic mine was expected about the middle of 1955. M. A. Hanna Co. (Richmond Iron Co.) operated the Richmond open pit; Inland Steel Co. operated the Morris and Greenwood mines; and Jones & Laughlin Steel Corp. operated the Tracy mine. North Range Mining Co. operated the Blueberry and Champion mines. The Blueberry mine was permanently closed in 1954 because the ore body was depleted. Ford Motor Co. operated the mine from 1928 to 1933, and it became a "show mine" because of the surface equipment. North Range Mining Co. assumed operation of the mine in 1933.

A. Lindberg & Sons, Inc., Ishpeming, produced miscellaneous stone for concrete aggregate. Champion, Inc. (Iron Mountain), A. Lindberg & Sons, Inc. (Ishpeming), Lake Superior & Ishpeming Railway Co., and the Marquette County Road Commission produced sand and gravel. Production was for engine, building and paving sand, and gravel for railroad ballast, building, and road construction.

Mason.—Minerals produced were bromine, calcium chloride, magnesium chloride, magnesium compounds, lime, peat, petroleum, and sand and gravel. The Dow Chemical Co. produced bromine, calcium chloride, lime, magnesium chloride, and magnesium compounds at Ludington. Peat was produced by Irving L. Pratt & Son, Scottville. The county road commission produced sand and gravel for road purposes. The county ranked ninth (4 percent) in the production of petroleum.

Mecosta.—Minerals produced were marl, petroleum, natural gas, and sand and gravel. Marl was produced by Wilson Frost, Blanchard. A. L. Dyer & Sons (McBrides), Steve Lyle Sand & Gravel (Big Rapids), and the county road commission produced gravel for road purposes.

Menominee.—The Limestone Products Co., Menominee, produced quicklime and hydrated lime for chemical and industrial uses. Champion, Inc., Iron Mountain, and the county road commission produced sand and gravel.

Midland.—Mineral products were elemental bromine, bromine compounds, calcium chloride, calcium-magnesium chloride, magnesium sulfate, potassium salts, and salt brine for manufacturing chemicals and sand and gravel. Production was by Dow Chemical Co. at Midland from brine obtained from wells near the plant. A. L. Dyer & Sons, McBrides, and the county road commission produced gravel for highway construction. Saginaw Core Sand Co., Saginaw, mined molding sand near Hemlock. Petroleum, natural gas, and natural gasoline were produced.

Missaukee.—Marl was produced by C. Stanley Hooker, Cadillac, for agricultural use. The State highway department placed contracts for road gravel. The county ranked eighth (5 percent) in the production of petroleum and third in the production of natural gasoline. Natural gas also was produced.

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Monroe.—Clay for pottery and stoneware was produced by F. W. Ritter & Sons Co., Inc., South Rockwood. The France Stone Co. of Toledo, Ohio, and Michigan Stone Co., Ottawa Lake, produced limestone for use as riprap, agricultural limestone, flux, concrete aggregate, and railroad ballast. Limestone for road construction was produced by and for the Monroe County Road Commission.

Maritime Trades, Inc., of Toledo, Ohio, dredged building sand from Lake Erie at Monroe. Petroleum was produced.

Montcalm.—A. L. Dyer & Sons (McBrides), Frank H. Stoerk (Pierson), Twin Lakes Sand & Gravel Co., Inc. (Riverdale), and the county road commission produced sand and gravel for building and road purposes. Petroleum was produced.

Montmorency.—The Montmorency County Road Commission produced road gravel.

Muskegon.—Hooker Electrochemical Co., Niagara Falls, N. Y., began to operate a plant at Montague, producing salt from artificial brines from wells in the Salina formation. The company produces chlorine and caustic soda. Molding sand, engine sand, sand for fill, and road sand and gravel were produced by Dobbs Truck & Crane Service, Nugent Sand Co., Inc., Muskegon; Harry Pickitt, Allegan; and Sand Products Corp., of Detroit, at Muskegon. Petroleum and natural gas were produced.

Newaygo.—Petroleum, natural gas, and sand and gravel were the mineral products of Newaygo County. Sand and gravel for building and road construction was produced by K. & V. Gravel Co., Fremont; Harry Pickitt of Allegan from a pit near Hesperia; and West Shore Construction Co., Zeeland.

Oakland.—Natco Corp. of Pittsburgh, Pa., produced clay for the manufacture of heavy clay products at its Birmingham plant. Over 6 million tons of sand and gravel was produced in the county. About 40 percent was employed in building construction and the remainder for highway use, railroad ballast, and miscellaneous purposes. Producers were American Aggregates Corp., of Greenville, Ohio; Floyd Beardslee, Pontiac; Benjamin Pit, Farmington; Dachill Trucking Co., Koenig Coal & Supply Co., Underwood Sand & Gravel Co., and Wolverine Contracting, Inc., all of Detroit; Foley & Beardslee and F. S. Ward, Clarkston; O. E. Gooding & Co., Ypsilanti; Kemler Bros., Rochester; Koon Gravel Co., Holly; Mickelson Bros., Oxford; and Lyle J. Walker Sand Gravel, of Hudson, at Rochester. Petroleum was produced.

Oceana.—Oceana County ranked fourth (7 percent) in the production of petroleum. Marl for agricultural use was produced by Beckman Bros. and Shelby and C. Stanley Hooker, Cadillac. West Shore Construction Co., Zeeland, produced road gravel from a pit near Hesperia. The Muskegon County Road Commission and the State highway department contracted for sand and gravel.

Ogemaw.—Ogemaw County was fifth (7 percent) in the production of petroleum. Sand and gravel was produced for road purposes by E. P. Brady Co., of Flint, at West Branch; Walter Rosevear Pit, West Branch; and the county road commission.

Ontonagon.—Calumet & Hecla, Inc., operated the Caledonia mine and produced some copper ore. White Pine Copper Co., a wholly owned subsidiary of Copper Range Co., completed virtually all con-

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struction work in 1954. Operation of the mill began October 5. Extracts from the White Pine Co. annual report for 1954 follow:

On March 10, 1952 the work of clearing the 270 acres required for the townsite and plant area at White Pine was started. During the intervening 33 months the building of this project has gone forward as planned and with few interruptions. The development of the mine and the construction of the buildings and installation of the equipment in the mill, smelter, power plant, with necessary auxiliary facilities for the townsite and plant, have been substantially completed and are now passing through the testing and start-up period and going into operation. A material part of this work was accomplished during the year. * * *

Mine development during the year was directed toward excavation of the belt tunnel, a crushing station, the opening of main drifts beyond the ventilating shafts and preparing production faces for mining operations. Excavation was completed for underground repair shops consisting of nine bays, 32 x 70 ft. each. All excavation and preliminary work in the underground crushing area has been completed and the installation of the crushers and necessary auxiliary equipment is proceeding. The installation of the speed-up belt and the 54-inch conveyor belt are going forward and should be completed in early 1955. During the year 805,356 tons of ore were mined and 112,295 tons of rock were broken principally from the belt tunnel and crusher area. Also 12,116 feet of main drift were completed and 120 working faces are available for mining operations. Drilling and blasting methods have been carefully studied to develop the most efficient and economical methods of mining, and gratifying progress has been made in this direction. Also important improvements in our mechanical equipment have been accomplished. Underground forces have been substantially increased during the year and our training program is proving satisfactory.

All surface conveyors have been completed. The crushing plant, housing two 7-foot Simons standard crushers of 750 t. p. h. capacity, together with related facilities, is in service. The entire mill building, with its three milling sections, was completed this year; each section is composed of two ball mills, four classifiers, one tube mill, 84 flotation machines and related auxiliary equipment. A 100-foot diameter thickener tank, the filter building housing two 10½ dia. x 18 ft. face drum-type filters and the tailings discharge pump house with ample pumping capacity were completed during the year. The tailings dam, 7600 feet in length with an estimated capacity of 30,000,000 tons and requiring a substantial amount of earth work, was completed with return water pump facilities. The recovery of the ore from the stockpile and conveying it to the crushing plant began September 14 and a total of 178,740 tons of ore were crushed by the year end. The operation of one section of the mill started October 5. Subsequently all three sections were put in operation with one section operating continuously. A total of 151,946 tons of ore were milled by the year end producing 4402 dry tons of concentrates. The performance of the mill during this difficult testing and start-up period has been excellent and shows promise of exceeding its rated capacity of 10,500 tons per day.

The smelter building with its 110 x 28 ft. reverberatory furnace, waste heat boiler, converter, holding furnace, refining furnace and casting wheel has been completed with all necessary auxiliary equipment in service. A second converter with blower and equipment is being installed and will be in operation in the first quarter of 1955. The flux-crushing and feed-and-storage buildings have been built and are in use. Heating of the reverberatory furnace began December 22 and as the desired temperatures were reached it was charged with slag for fusing the bottom. This was completed by the year end and the furnace is being tempered in preparation to start the smelting of concentrates. The other furnaces and equipment are being heated and readied for the refining and pouring of copper. Here again it appears this facility will exceed its rated capacity.

The power plant with an installed capacity of 45,000 k. v. a. has been completed and all three generating units put into operation. No. 2 turbogenerator unit was placed on the line August 30, No. 3 unit was started on October 30 and No. 1 unit was started on November 22. The total station output for the year was 15,028,000 KWH of which 3,338,000 KWH was delivered to the Upper Peninsula Power Company. The heating boiler, now coal-fired, has provided heat and hot water to the process and non-process buildings throughout the year. It seems certain that this power plant, complete and modern in every detail, will produce power at a comparatively low cost and well within our estimates.

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The plant railroad consist of five miles of track has been completed thus furnishing rail service to all buildings in the works area requiring these facilities. A track scale of 300,000 pounds capacity has been placed in service at the Interconnection with the track of the D. S. S. & A. Railroad. A car thaw pit has been installed to facilitate unloading of coal and material during the winter months. Stockpile areas for coal, limestone, silica and pyrite have been prepared at convenient locations and are in use. The sub-base for all roads has been placed and grading has been completed for drainage ditches throughout the plant site. Asphalt paving for the roads and parking lots will be laid this coming year.

The pumping station at Silver City on the shore of Lake Superior, approximately 6½ miles from White Pine, was placed in operation on July 19. This station is equipped with a pumping capacity of 17,000 gallons per minute delivered through a 36-inch reinforced concrete pipe to White Pine. The service water pump house and the process water plant at White Pine have been put in service. A spray pond with a capacity of 1,250,000 gallons has been completed and the water treatment plant, modern in all respect with sand filters, chlorination and fluoridation is in operation. At present the Lake pumping station is delivering an average of 11,000,000 gallons per day of which 300,000 gallons are treated for potable use and the remainder going to the mill for process water and to the power plant.

The number of people applying for employment during the year was adequate to fill our requirements and the rate of turnover appears somewhat below the industry average. The number of people employed by the Company increased from 245 on January 1 to 655 on December 31. There were two work interruptions during the year resulting in eighteen days of lost time.

The State highway department contracted for road gravel.

Osceola.—Osceola County ranked sixth (6 percent) in the production of petroleum and fifth in the production of natural gas. Hersey Gravel Co., Hersey, produced gravel for highway construction and railroad ballast.

Oscoda.—The State highway department contracted for road gravel. Some petroleum also was produced.

Otsego.—Hutchins Sand & Gravel Co., Gaylord, and the county road commission produced sand and gravel for building and road purposes. Some natural gas also was produced.

Ottawa.—Marl for agricultural use was produced by Ralph Meyers, West Olive, and Wierenga Bros., Spring Lake. Sand and gravel for molding sand, engine sand, and road construction was produced by Bunce Gravel Co., Ravenna; William Huizenga, Zeeland; Tom Johnston Gravel Co. and Standard Sand Co., Grand Haven; Harry Pickitt of Allegan, Allendale; and West Shore Construction Co., of Zeeland, at Holland. Petroleum and natural gas were produced.

Presque Isle.—Michigan Limestone Division of United States Steel Corp., the largest producer in Michigan, produced crushed limestone for flux, concrete aggregate, agricultural use, manufacture of cement and lime, and various chemical and industrial uses. The Onaway Stone Co., Onaway, quarried limestone for use as rubble, flagging, house veneer, and rough construction stone. Straits Aggregate & Equipment Corp. of East Tawas, produced sand and gravel for building, paving and railroad ballast at Millersburg. Road gravel was produced by E. P. Brady & Co. of Flint at Case and by Harry Pickitt of Allegan at Rogers City. The State highway department contracted for road gravel.

Roscommon.—Petroleum, natural gas, and natural gasoline were produced.

Saginaw.—Two companies producing clays were Minco Products Corp. and Saginaw Clay Products Co., both of Saginaw. Production

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was principally for refractories, foundry use, insecticides, fillers, fertilizer, and drilling mud. Petroleum was produced.

St. Clair.—Portland cement was produced by Peerless Cement Corp. at Port Huron. Diamond Crystal Salt Co., St. Clair, and Morton Salt Co., Chicago, Ill., produced evaporated salt from well brines. Green Thumb Peat Humus Co., Sandusky, and Michigan Peat, Inc., produced peat from bogs near Capac. William Click, Sr., Goodells, produced building sand and gravel. The Sanilac County Road Commission and the State highway department contracted for road gravel. Natural gas also was produced.

St. Joseph.—Production of marl for agricultural use was reported by Leslie Knox and Kenneth L. Wood of Colon. Sand and gravel for building and road construction was produced by Aggregate Processors, Inc., White Pigeon; Harry Pickitt, of Allegan, at Hawardsville; West Shore Construction Co , of Zeeland, at Leonidas and Sturgis; and the county road commission.

Sanilac.—Robert Van Camp, Croswell, produced sand and gravel for building and road construction. Glenn A. Comstock, Bay City, and Peters Washed Sand and Gravel Co., Decker, produced road gravel. The county road commission produced road gravel and the State highway department contracted for the production of road gravel.

Schoolcraft.—Inland Lime & Stone Division of the Inland Steel Co. produced limestone for flux, riprap, concrete, railroad ballast, agricultural use, manufacture of cement and lime, and various chemical and industrial uses. E. P. Brady, Flint, and the county road commission produced road gravel.

Shiawassee.—Clays for the manufacture of heavy clay products were produced by Michigan Vitrified Tile Co. of Findlay, Ohio. Fuoss Gravel Co. and Shenk Gravel Co. (Durand) and Parks Sand & Gravel (Perry) produced sand and gravel for building and road purposes.

Tuscola.—Andersen Sand & Gravel Co. and Saginaw Core Sand Co. (Saginaw), Bernthal Sand & Gravel Co. (Reese), C. R. Hunt and E. L. Schwaderer (Cass City), Great Lakes Foundry Sand Co. (Detroit), Peterhans Bros. and Vaughans Sand & Gravel Co. (Caro), and the county road commission produced sand and gravel for molding sand and building and road construction. Some petroleum also was produced.

Van Buren.—Garrett Sand Co. (South Haven), John G. Yerington (Benton Harbor), and Harry Pickitt (Allegan) at Paw Paw produced sand and gravel for molding sand and road use. Some petroleum also was produced.

Washtenaw.—Nearly 2¼ million tons of sand and gravel was produced in the county. Producers were Harry Pickitt (Allegan), Killins Gravel Co. (Ann Arbor), Chubb Sand & Gravel Co. (Northville), Thumms's Sand & Gravel and Whittaker & Gooding Co. (Ypsilanti), and the county road commission. Petroleum and natural gas were also produced.

Wayne.—Minerals and mineral products produced in Wayne County in 1954 were cement, clay, gypsum products, limestone, salt, sand and gravel, and ground sandstone. Companies producing cement were Wyandotte Chemicals Corp., Wyandotte, and Peerless Cement Corp.,

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Detroit. Limestone used in cement manufacture at both plants was produced in other counties. Edward Kraemer & Sons, Plain, Wis., and Michigan Foundation Quarry Co., Trenton, produced crushed limestone for riprap and concrete aggregate. Producers of clays were Clippert Brick Co. (Detroit), Flat Rock Clay Products Co. (Flat Rock), and Light Weight Aggregate Corp. (Livonia) for the manufacture of heavy clay products, tile, and cement and for lightweight aggregates. United States Gypsum Co., Chicago, Ill., operated a calcining and gypsum products plant at Detroit. Michigan Silica Co., Rockwood, produced crushed and ground sandstone for use in abrasives and foundries and for other applications. Salt from well brines, for evaporated salt and the manufacture of chemicals, was produced by Solvay Process Division, Allied Chemical & Dye Corp., at Detroit; and Pennsylvania Salt Manufacturing Co. and Wyandotte Chemicals Corp., both at Wyandotte. The International Salt Co., operating an underground salt mine at Detroit, was the only producer of rock salt in the State.

Continental Sand Co., W. L. Emery Co., and Wolverine Contractors, Inc. (Detroit), Manning & Locklin Gravel Co. and Northville Sand & Gravel Co. (Northville), Harry Pickitt (Allegan), Michigan Silica Co. (Rockwood), and Moore Bros. Sand & Gravel and Wayne Sand & Gravel Co. (Wayne) produced sand and gravel for glass, molding and blast sand, and building and road construction. Wayne County ranked first in the production of salt, second in the production of cement, and fourth in the production of sand and gravel.

Wexford.—Wexford Gravel Co., Cadillac, produced building gravel.

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The Mineral Industry of Minnesota

By Matthew G. Sikich[1]

MINERAL production in Minnesota in 1954 was valued at $351 million, a decrease of 35 percent from that in 1953. Slackened demand for iron ore by the steel industry during the year was the chief reason for the decrease; shipments were about 40 percent less than the previous year. Value of production below 1953 was also reported for abrasive stone, marl, and manganiferous ore. Values of cement, clays, lime, peat, sand and gravel, and stone produced were greater than in 1953. New alltime highs were recorded in the production of cement, sand and gravel, and stone.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

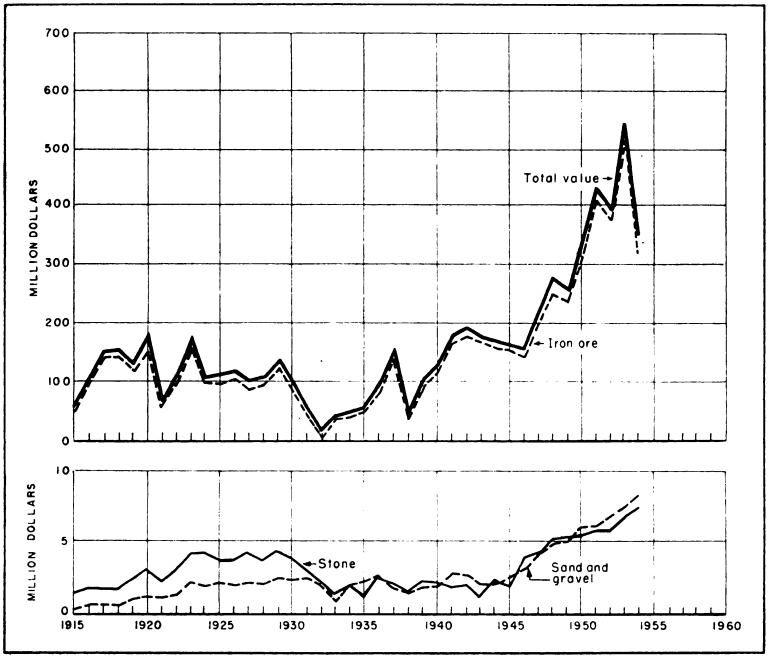

FIGURE 1.—Value of total mineral production, iron ore shipments, sand and gravel, and stone produced in Minnesota, 1915–54.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Minneapolis, Minn.

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TABLE 1.—Mineral production in Minnesota, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	91,401	$149,384	(2)	(2)
Iron ore (usable)—long tons, gross weight	80,533,670	517,850,509	48,613,338	$319,632,491
Manganiferous ore (5 to 35 percent Mn), gross weight	1,091,491	(2)	504,057	(2)
Sand and gravel	19,774,411	7,304,351	23,848,856	16,318,520
Stone (except limestone for cement and lime, 1953)	[3] 2,270,543	6,587,096	2,629,456	7,485,291
Undistributed: Abrasive stones (grinding pebbles, tube-mill liners), portland cement, lime, marl (calcareous), peat (1954), quartzite (1954), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2)		10,653,888		8,205,868
Total Minnesota		542,545,000		[4] 351,475,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Bureau of Mines not at liberty to publish, included with "Undistributed."
[3] Revised figure.
[4] Total has been adjusted to eliminate duplication in the value of stone.

REVIEW BY MINERAL COMMODITIES

METALS

Iron Ore.—Minnesota accounted for over 64 percent of United States production of usable iron ore (direct-shipping, concentrate, and sinter) in 1954. However, production, as measured by shipments, was the lowest on record since 1940 and 40 percent below the record high established in 1953. The chief reason for this decrease was the drop in demand by the steel industry, which produced at only 71 percent of average rated ingot capacity in 1954. Total shipments of 48.6 million long tons consisted of 29,418,768 tons of direct-shipping ore and 19,194,570 tons of concentrate, of which 1,335,379 tons was agglomerated by pelletizing, nodulizing, or sintering. The proportion of direct-shipping grades to the total shipments in 1954 was 60.5 percent compared with 67.5 percent in 1953. The average iron content of usable iron ore (direct-shipping ore plus concentrate) produced during the year was 50.94 percent, natural analysis, compared with 50.31 in 1953.

Iron ore was shipped by 29 companies operating in Crow Wing, Fillmore, Itasca, and St. Louis Counties. Shipments from the Mesabi range (in Itasca and St. Louis Counties) constituted 93 percent of the total shipments from the State in 1954.

The average mine value per gross ton of iron ore shipped, as reported by producing companies in the State in 1954, was $6.57 compared with $6.43 in 1953. Throughout 1954 Lake Erie base prices were: Mesabi non-Bessemer and High-Phosphorus, $9.90 per gross ton; Mesabi Bessemer, $10.05; Old Range non-Bessemer, $10.15; Old Range Bessemer, $10.30; and open-hearth lump ore, $11.15. Base prices are for ore delivered at lower Lake ports, carrying 51.5 percent

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natural iron content for non-Bessemer grades, and with an additional 0.045 percent phosphorus (dry) for Bessemer grades. Premiums and penalties were applied for variations in analyses and physical structure. Non-Bessemer grades constitute the bulk of the tonnage shipped from Minnesota mines.

Iron ore from mines in the State was either hauled by rail to ore docks at Duluth and Two Harbors, Minn., and Superior, Wis., for lake shipment to lower Lake ports, or it was shipped all-rail to consuming furnaces. The first lake shipment of Minnesota iron ore in 1954 was from Two Harbors on April 19. Initial shipments from Superior, Wis., and Duluth were on April 20 and April 21, respectively. Port closing dates for these harbors were Duluth, October 26; Two Harbors, November 18; and Superior, November 29. In 1954 the decline in demand for ore, rather than the weather, determined closing dates for lake shipments. The weather during the 1954 shipping season was ideal for lake shipping with infrequent storms and temperatures that held steaming of frozen ore to a minimum.

Substantial progress was made during the year in the development of the new taconite industry in St. Louis, Lake, and Cook Counties, with a tremendous building program underway on the eastern end of the Mesabi range and on the north shore of Lake Superior.

Reserve Mining Co., owned jointly by Armco Steel Co. and Republic Steel Corp., was engaged in constructing its large-scale taconite plant, the E. W. Davis Works, at Silver Bay, in Lake County. The initial plant, consisting of 12 sections and with an annual capacity of 3.75 million tons of finished product, was scheduled to go into production late in 1955. Ultimate capacity of this plant will be 10 million tons of high grade concentrate yearly. Reserve Mining Co. has been producing taconite pellets at its pilot plant near Babbitt, 47 miles by rail from Silver Bay, since 1952. The company taconite mine is also near Babbitt.

Erie Mining Co. continued construction of its commercial taconite plant near the mine site, about 5 miles northeast of Aurora, in St. Louis County. The plant was designed for an initial annual production of 7.5 million tons of pelletized concentrate. Erie Mining Co. has operated its preliminary taconite plant near Aurora since 1948. This plant, with an annual capacity of 200,000 tons of pellets, was the first full-scale taconite pilot plant in operation. The company also made considerable progress in constructive dock and harbor facilities at Taconite Harbor, in Cook County, which will be the shipping port for transporting iron-ore pellets produced at its new plant near Aurora. A company-owned railroad 73 miles long was to connect the concentration plant and the harbor.

Oliver Iron Mining Division of United States Steel Corp. operated its taconite pilot plant and mine, the Pilotac, near Mountain Iron. Taconite concentrate was first shipped from this operation in 1953. Speculation has arisen concerning the choice of Oliver's site for its full-scale taconite production, which had not been announced as of the end of 1954.

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TABLE 2.—Total usable iron ore produced (direct-shipping, concentrate, and sinter), 1884–1954,[1] by ranges, in gross tons [2]

Year	Cuyuna	Mesabi	Vermilion	Spring Valley district	Total
1884–1941	27,987,265	1,178,414,192	70,520,400	47	1,276,921,904
1942	1,655,485	70,287,664	1,935,125	59,171	73,937,445
1943	1,747,304	65,334,939	1,782,237	220,427	69,084,907
1944	1,417,256	61,994,023	1,466,816	----------	64,878,095
1945	1,784,010	58,355,320	1,481,007	----------	61,620,337
1946	1,380,120	46,678,679	1,232,008	----------	49,290,807
1947	2,100,846	58,772,404	1,471,879	147,787	62,492,916
1948	2,030,281	64,071,983	1,580,497	352,979	68,035,740
1949	1,826,711	52,551,346	1,381,327	102,158	55,861,542
1950	2,480,843	60,838,025	1,580,217	335,470	65,234,555
1951	2,651,724	73,574,908	1,806,818	452,405	78,485,855
1952	2,369,180	59,370,538	1,573,748	476,242	63,789,708
1953	2,900,579	75,324,236	1,643,039	217,760	80,085,614
1954	1,497,296	45,724,827	1,371,967	157,681	48,751,771
Total	53,828,900	1,971,293,084	90,827,085	2,522,127	2,118,471,196

[1] Shipments first recorded from the Cuyuna range in 1911, the Mesabi range in 1892, the Vermilion range in 1884, and the Spring Valley district in 1941.
[2] Exclusive after 1905 of iron ore containing 5 percent or more manganese.

TABLE 3.—Production, shipments, and stocks of usable iron ore (direct-shipping, concentrate, and sinter) in 1954, by counties and ranges, in gross tons [1]

County or range	Stocks Jan.	Production	Shipments	Stocks Dec. 31	Iron content of production (in gross tons)
County:					
Crow Wing	427,543	1,497,296	1,708,893	215,946	748,271
Fillmore	158,140	157,681	150,512	165,309	75,699
Itasca	779,921	10,804,525	10,715,333	869,113	5,647,063
St. Louis	714,852	36,292,269	36,038,600	968,521	18,363,745
Total	2,080,456	48,751,771	48,613,338	2,218,889	24,834,778
Range:					
Cuyuna	427,543	1,497,296	1,708,893	215,946	748,271
Mesabi	1,304,710	45,724,827	45,415,583	1,613,954	23,242,899
Vermilion	190,063	1,371,967	1,338,350	223,680	767,909
Spring Valley district (Fillmore County)	158,140	157,681	150,512	165,309	75,699
Total	2,080,456	48,751,771	48,613,338	2,218,889	24,834,778

[1] Exclusive of ore containing 5 percent or more manganese.

Manganiferous Ore.—In 1954 shipments of manganiferous iron ore (containing 5 to 10 percent manganese, natural) and ferruginous manganese ore (containing 10 to 35 percent manganese, natural) totaled 504,057 short tons (450,051 long tons), a 54-percent decrease below the tonnage in 1953. Shipments during the year consisted of 64,903 short tons of direct-shipping grade and 439,154 short tons of concentrate. Not included in figures for 1954 was 1,878 short tons of ferruginous manganese ore shipped to the Government stockpile. A small quantity of manganiferous ore was sold for paint use.

All production of manganiferous ore in the State in 1954 was from five mines in Crow Wing County in the Cuyuna range. Companies operating during the year were Hanna Coal & Ore Corp., Pickands Mather & Co., and Zontelli Bros., Inc.

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Over 99 percent of the total manganiferous ore shipped to date from mines in Minnesota has come from the Cuyuna range. Table 4 shows shipments, with average iron and manganese contents, of usable manganiferous iron ore and ferruginous manganese ore from mines in the Cuyuna range, 1913–54.

Ores containing over 5 percent manganese, natural, have generally been priced as Old Range non-Bessemer on the combined natural iron and manganese content, plus a premium for the natural manganese exceeding 5 percent.

Manganese Chemicals Corp. reported sales of manganese carbonate, manganese dioxide, and other manganese products from its plant at Riverton. All were produced from Cuyuna-range ores.

TABLE 4.—Shipments, with average iron and manganese contents, of usable [1] manganiferous iron ore (containing 5 to 10 percent Mn, natural) and ferruginous manganese ore (containing 10 to 35 percent Mn, natural) from mines in the Cuyuna range, 1913–54, in gross tons

Year	Manganiferous iron ore			Ferruginous manganese ore			Total shipments
	Shipments	Contents (natural)		Shipments	Contents (natural)		
		Fe, percent	Mn, percent		Fe, percent	Mn, percent	
1913				26,200	46.00	(2)	26,200
1914				55,192	(2)	(2)	55,192
1915				42,973	33.84	16.42	42,973
1916	45,712	(2)	(2)	193,257	[3] 32.18	13.83	238,969
1917	91,590	48.58	7.65	359,542	33.29	14.85	451,132
1918	227,202	46.61	5.87	625,009	[3] 33.76	[3] 14.53	852,211
1919	98,220	40.80	7.31	138,952	[3] 38.23	[3] 12.61	237,172
1920	248,913	37.57	6.82	293,524	44.76	12.46	542,437
1921	56,530	36.67	8.82				56,530
1922	248,560	[3] 44.57	6.41	305,093	41.50	10.32	553,653
1923	499,181	36.63	7.42	253,634	39.25	10.83	752,815
1924	361,527	36.01	7.51	159,915	34.27	11.21	521,442
1925	741,409	35.58	7.79	77,665	34.15	11.04	819,074
1926	799,458	36.56	7.35	158,759	34.06	10.39	958,217
1927	934,599	37.98	7.73	6,276	34.15	13.57	940,875
1928	1,025,014	37.38	7.77	3,487	(2)	11.53	1,028,501
1929	1,004,420	36.63	7.52	5,421	30.64	17.11	1,009,841
1930	693,546	37.61	7.39	[4] 4,235	34.26	15.37	[4] 697,781
1931	217,352	38.12	7.54	26,567	36.50	15.81	243,919
1932				1,399	(2)	12.44	1,399
1933	171,722	36.10	7.83				171,722
1934	197,622	37.35	7.70				197,622
1935	419,373	(2)	7.37	77,931	37.82	10.85	497,304
1936	840,725	35.98	7.87	47,796	33.88	10.85	888,521
1937	1,173,637	36.44	7.62	84,263	31.33	17.30	1,257,900
1938	259,183	35.84	7.52	17,424	31.53	17.37	276,607
1939	469,703	36.67	7.21	182,260	35.93	11.69	651,963
1940	797,642	38.28	7.34	248,732	[4] 34.76	13.02	1,046,374
1941	819,226	36.71	6.90	365,942	[3] 35.02	12.64	1,185,168
1942	1,299,826	38.04	8.02	79,026	34.67	15.14	1,378,852
1943	1,070,596	43.06	7.74	226,588	31.81	15.61	1,297,184
1944	977,583	36.90	7.65	109,612	33.15	13.98	1,087,195
1945	1,246,294	38.04	6.77				1,246,294
1946	955,977	37.84	6.31				955,977
1947	930,144	36.92	6.00				930,144
1948	1,070,110	36.48	6.03				1,070,110
1949	881,000	36.93	5.81	3,109	36.10	11.11	884,109
1950	[4] 762,071	37.59	6.17	14,470	31.91	11.04	[4] 776,541
1951	885,824	36.93	6.05	13,150	33.33	12.17	898,974
1952	773,260	38.40	5.77	28,127	32.38	10.61	801,387
1953	795,001	37.79	5.69	179,545	33.73	11.62	974,546
1954	443,308	40.65	5.65	6,743	[5] 32.51	[5] 11.80	450,051
Total	24,533,060			4,421,818			28,954,878

[1] Direct shipping and beneficiated ore.
[2] Figure not available.
[3] Partly estimated.
[4] Revised figure.
[5] Based on dry analysis.

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NONMETALS

Abrasives.—The Jasper Stone Co. produced grinding pebbles and tube-mill liners from a quartzite depostit in Rock County. The total sales of these abrasive stones in 1954 increased slightly over the previous year. Minnesota is one of the few States from which production of grinding pebbles and tube-mill liners was reported in 1954.

Cement.—Portland and masonry cements were produced at Duluth in St. Louis County by the Universal Atlas Cement Co., the only cement producer in Minnesota. Production of types I and II (general-use and moderate-heat), type III (high-early-strength), type V (sulfate-resisting), air-entrained, and masonry mixes other than special portlands was reported in 1954. The average mill value per barrel of portland cement increased in 1954 to $2.78, compared with $2.69 in 1953.

Clays.—Fire clay and miscellaneous clay for the manufacture of brick, pottery, stoneware, and heavy clay products were produced by 8 companies operating in 7 counties in 1954. Fire clay was produced in Carlton and Goodhue Counties; other clays, in Beltrami, Brown, Carlton, Dakota, Polk, and Winona Counties. The total value of clays sold or used by producers in the State in 1954 was slightly greater than in 1953.

Lime.—Shipments of quicklime and hydrated lime were reported by the State's only lime producer, the Cutler-Magner Co., which operated a plant at Duluth. The value of sales increased slightly over 1953, although the quantity shipped in 1954 was less than in the previous year. The products were sold for building, agricultural, industrial, and chemical uses. Limestone used in manufacturing lime in Minnesota was obtained from Michigan.

Marl.—Calcareous marl was produced in Chisago and Crow Wing Counties for agricultural use. The value of production in 1954 was 11 percent less than in 1953; however, based on tonnage, production increased 11 percent over the previous year.

Perlite.—Crude perlite produced in Western States was expanded in Minneapolis. The expanded product was used chiefly as a lightweight aggregate in plaster and concrete.

Sand and Gravel.—Sand and gravel deposits are widespread in Minnesota. In 1954 production of 24 million short tons was reported from 75 of the State's 87 counties, establishing a new alltime high. The previous record year was 1952. Production increased 21 percent over 1953, principally because of the demand for sand and gravel for building and road construction. The increase was also due in part to increased statistical coverage as a result of the joint Bureau of Mines–Bureau of the Census canvass of the industry in 1954. The 10 leading commercial producers in 1954 were: Becker County Sand & Gravel Co. and Hallett Construction Co., Crosby; Concrete Service Inc., Fred W. Hedberg & Sons, Industrial Aggregates Co., and Landers-Norblom-Christenson Co., all of Minneapolis; Fairway Construction Co., Hector; Cemstone Products Co. and J. L. Shiely Co., St. Paul; and Winona Sand & Gravel Co., Winona.

Silica sand was produced from the Jordan sandstone and St. Peter sandstone formations in Le Sueur and Ramsey Counties, respectively.

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These friable sandstones contain little cementing material and are easily mined and processed, producing a nearly pure silica sand. In 1954 the material was used for manufacturing glass and for filter purposes.

Table 5 shows production and value data for commercial and Government-and-contractor sand and gravel operations in Minnesota, by uses, for 1953–54.

TABLE 5.—Sand and gravel sold or used by producers, 1953–54, by classes of operations and uses

Class of operation and use	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Glass	6,254	$13,865	$2.22	(1)	(1)	(1)
Building	1,963,605	1,551,800	.79	2,993,532	$2,424,008	$0.81
Paving	843,976	767,532	.91	887,763	638,583	.72
Railroad ballast	28,893	8,297	.29	1,917	568	.30
Other	63,288	37,306	.59	94,289	63,820	.68
Undistributed [2]	33,090	40,543	1.23	53,290	139,076	2.61
Total commercial sand	2,939,106	2,419,343	.82	4,030,791	3,266,055	.81
Gravel:						
Building	1,215,413	1,735,049	1.43	2,318,437	3,249,287	1.40
Paving	2,214,272	1,517,922	.69	3,677,918	3,053,817	.83
Railroad ballast	1,101,877	448,575	.41	932,618	550,305	.59
Other	181,387	64,808	.36	353,960	161,349	.46
Total commercial gravel	4,712,949	3,766,354	.80	7,282,933	7,014,758	.96
Total commercial sand and gravel	7,652,055	6,185,697	.81	11,313,724	10,280,813	.91
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building	369	159	.43	10,800	2,700	.25
Paving	184,167	47,193	.26	92,205	49,247	.53
Total Government-and-contractor sand	184,536	47,352	.26	103,005	51,947	.50
Gravel:						
Building				102,942	41,177	.40
Paving	11,937,820	1,071,302	.09	12,329,185	5,944,583	.48
Total Government-and-contractor gravel	11,937,820	1,071,302	.09	12,432,127	5,985,760	.48
Total Government-and-contractor sand and gravel	12,122,356	1,118,654	.09	12,535,132	6,037,707	.48
ALL OPERATIONS						
Sand	3,123,642	2,466,695	.79	4,133,796	3,318,002	.80
Gravel	16,650,769	4,837,656	.29	19,715,060	13,000,518	.66
Grand total	19,774,411	7,304,351	.37	23,848,856	16,318,520	.68

[1] Included with "Undistributed."

[2] Includes molding, engine, filter sand (1953 and 1954), and blast and glass sand (1954 only) to avoid disclosure of individual company operations.

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Stone.—Production of granite, limestone, and quartzite was recorded in the State in 1954. Granite was produced in 10 counties. The most important economic uses were for building and monumental purposes. The granites used as building facings and monuments range from a light to a dark gray and light pink to dark red. The greater portion is dressed within the State, although some rough stone was marketed in 1954. Crushed granite for railroad ballast and other uses also was produced. The total production of granite in 1954 was 603,000 short tons valued at $4 million, about 24 percent more in quantity and 27 percent in value than in 1953.

Limestone was produced during the year from deposits along the Minnesota and Mississippi Rivers in the eastern and south-central part of the State. Most of the limestone production was crushed for use as concrete aggregate and roadstone and for agricultural purposes. Massive limestone was quarried in Blue Earth, Dakota, Hennepin, Le Sueur, and Winona Counties. This stone is cream, light pink, and buff and is used extensively as a building facing. A considerable portion is dressed as ashlar and as split face for house veneer. Total production of limestone in 1954 was 2 million short tons valued at $3.3 million, 13 percent greater in volume but only slightly greater in value than in 1953.

Quartzite was produced in Rock County for use as riprap.

The total production of stone in 1954 established a new alltime record, surpassing the previous high of 1952.

TABLE 6.—Granite sold or used by producers in 1953–54, by uses

Use	1953			1954		
	Quantity	Value		Quantity	Value	
		Total	Average per unit of measure		Total	Average per unit of measure
Dimension:						
Rubble—short tons	12,995	$29,275	$2.25	[1] 62,973	[1] $82,081	[1] $1.30
Rough architectural—cubic feet				4,000	10,000	2.50
Rough monumental—do	16,771	59,263	3.53	(1)	(1)	(1)
Dressed architectural—do	39,844	450,744	11.31	73,742	985,345	13.36
Dressed monumental—do	171,725	2,191,194	12.76	162,608	2,373,917	14.60
Total dimension equivalent short tons [2]	31,947	2,730,476	85.47	82,922	3,451,343	41.62
Crushed and broken:						
Riprap—short tons	1,600	1,600	1.00			
Concrete aggregate and roadstone—do	90,235	131,719	1.46	122,773	186,103	1.52
Railroad ballast—do	356,651	362,435	1.02	[3] 397,483	[3] 507,344	[3] 1.28
Other—do	4,100	24,600	6.00	(3)	(3)	(3)
Total crushed and broken—do	452,586	520,354	1.15	520,256	693,447	1.33
Grand total—do	484,533	3,250,830	6.71	603,178	4,144,790	6.87

[1] Figures for rubble and rough monumental use are combined to avoid disclosure of individual company operations.
[2] Average weight of 166 pounds per cubic foot used to convert cubic feet to short tons.
[3] Figures for railroad ballast and "Other" are combined to avoid disclosure of individual company operations.

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TABLE 7.—Limestone sold or used by producers in 1953–54, by uses

Use	1953			1954		
	Quantity	Value		Quantity	Value	
		Total	Average per unit of measure		Total	Average per unit of measure
Dimension:						
Rough construction and rubble, short tons	6,729	$25,535	$3.79	3,060	$3,535	$1.16
Architectural, cubic feet	123,288	278,050	2.26	89,300	62,050	.69
Dressed (cut and sawed), do	[1] 184,199	[1] 689,650	3.74	153,275	689,200	4.50
Flagging, do	21,250	15,600	.73	12,775	8,680	.68
Total dimension equivalent, short tons [2]	[1] 33,028	[1] 1,008,835	30.54	23,488	763,465	32.50
Crushed and broken:						
Riprap:						
Commercial, short tons	86,970	78,363	.90	26,937	37,621	1.40
Noncommercial, do	716	800	1.12			
Flux, do	1,850	3,675	1.99	350	1,050	3.00
Concrete aggregate and roadstone:						
Commercial, do	1,230,840	1,547,382	1.26	1,614,911	1,910,750	1.18
Noncommercial, do	99,285	102,262	1.03	47,300	47,300	1.00
Railroad ballast, do	2,780	4,501	1.62	1,000	1,950	1.95
Agriculture, do	289,016	435,096	1.51	273,002	402,297	1.47
Other uses, do	41,525	155,352	3.74	39,290	176,068	4.48
Total crushed and broken, do	1,752,982	2,327,431	1.33	2,002,790	2,577,036	1.29
Grand total, do	[1] 1,786,010	[1] 3,336,266	1.87	2,026,278	3,340,501	1.65

[1] Revised figure, includes stone previously classified as marble.
[2] Average weight of 160 pounds per cubic foot used to convert cubic feet to short tons.

MINERAL FUELS

Peat.—The Colby Pioneer Peat Co. of Hanlontown, Iowa, produced moss peat in 1954 in Aitkin County, the first commercial production recorded in Minnesota since 1950. Production in 1954 was used chiefly for horticultural purposes. Peat reserves in Minnesota, estimated on an air-dried basis and occurring in deposits more than 5 feet thick, were reported in 1919 to total 6,835,300,000 net tons.[2] Except for Russia, Minnesota has the largest known deposit of peat in the world. The Minnesota Iron Range Resources and Rehabilitation Commission has done considerable research work, having as its goal development of new industries within the State through utilization of peat and other natural resources. Consideration has been given to the possible uses of peat in beneficiative low-grade iron ores, especially since large peat bogs are not too distant from the iron-ore deposits of the Mesabi range.

REVIEW BY COUNTIES

Aitkin.—Moss peat for horticultural use was produced during the year by the Colby Pioneer Peat Co. of Hanlontown, Iowa, from a bog near Floodwood.

Becker.—The Becker County Sand & Gravel Co., Crosby, produced engine sand, gravel for railroad ballast, and sand and gravel

[2] Soper, E. K., The Peat Deposits of Minnesota: Minnesota Geol. Survey Bull. 16, 1919.

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for building and road construction. Ernest G. Anderson, Detroit Lakes, produced road gravel. The county highway department produced and contracted for sand and gravel for road use.

Beltrami.—Clay for building brick was produced by the Bemidji Brick Co., Bemidji. Road gravel was produced by Lindquist, Olson & Co., Cambridge; Melvin Samuelson, Bemidji; and the county highway department. Road gravel was also produced under contract for the county highway department and the United States Army Corps of Engineers. Ritchie & Tell, Bemidji, produced sand and gravel for building purposes.

Big Stone.—Granite for architectural and monumental purposes was produced by Cold Spring Granite Co., Cold Spring; and the Delano Granite Works, Inc., Delano.

TABLE 8.—Value of mineral production in Minnesota, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value
Aitkin	$2,820	(2)	Peat.
Anoka	3,260	$3,750	Sand and gravel.
Becker	10,759	402,609	Do.
Beltrami	18,523	52,425	Sand and gravel, clays.
Benton	21,005	10,877	Sand and gravel.
Big Stone	1,050,484	(2)	Stone.
Blue Earth	692,654	401,349	Sand and gravel, stone.
Brown	172,697	96,649	Sand and gravel, clays.
Carlton	90,606	141,217	Do.
Cass	2,181	14,604	Sand and gravel.
Chippewa	5,100	110,494	Sand and gravel, stone.
Chisago	12,471	157,871	Sand and gravel, marl.
Clay	59,453	236,490	Sand and gravel.
Cook	11,250	24,976	Do.
Cottonwood	57,654	50,970	Do.
Crow Wing	21,958,807	12,678,592	Iron ore, manganiferous ore, sand and gravel, marl.
Dakota	434,501	521,364	Stone, sand and gravel, clays.
Dodge	32,049	37,081	Stone.
Douglas	3,097	25,002	Sand and gravel.
Faribault	7,486	147,310	Sand and gravel, stone.
Fillmore	1,910,684	1,030,809	Iron ore, stone.
Freeborn	(2)	125,190	Sand and gravel.
Goodhue	419,868	358,630	Stone, sand and gravel, clays.
Grant	(2)	43,793	Sand and gravel.
Hennepin	2,072,226	2,654,628	Sand and gravel, stone.
Houston	115,149	263,859	Stone, sand and gravel.
Isanti	16,646	23,120	Sand and gravel.
Itasca	110,606,394	74,461,837	Iron ore, sand and gravel.
Jackson	19,552	81,261	Sand and gravel.
Kanabec	272,351	30,976	Stone, sand and gravel.
Kandiyohi	213,276	335,988	Sand and gravel.
Kittson	----------	(2)	Do.
Lac qui Parle	265,965	330,965	Sand and gravel, stone.
Lake	15,012	16,523	Sand and gravel.
Lake of the Woods	8,624	13,674	Do.
Le Sueur	474,050	724,459	Stone, sand and gravel.
Lincoln	23,668	34,044	Sand and gravel.
Lyon	(2)	(2)	Do.
Mahnomen	7,866	5,720	Do.
Marshall	21,792	84,789	Do.
Martin	27,572	69,791	Do.
McLeod	10,199	37,611	Do.
Meeker	----------	175,190	Do.
Mille Lacs	(2)	256,169	Stone, sand and gravel.
Morrison	23,407	(2)	Sand and gravel.
Mower	213,676	149,561	Stone, sand and gravel.
Murray	----------	19,369	Sand and gravel.
Nicollet	6,824	63,213	Do.
Nobles	13,264	67,407	Do.
Norman	400	----------	
Olmsted	112,943	186,105	Stone, sand and gravel.
Otter Tail	70,927	58,254	Sand and gravel.
Pennington	----------	23,361	Do.
Pine	(2)	28,403	Do.
Pipestone	(2)	(2)	Do.
Polk	223,942	98,950	Sand and gravel, clays.

See footnotes at end of table.

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TABLE 8.—Value of mineral production in Minnesota, 1953–54, by counties[1]—Con.

County	1953	1954	Minerals produced in 1954 in order of value
Pope	$54,687	(2)	Sand and gravel.
Ramsey	1,197,518	$57,035	Do.
Redwood	21,500	40,229	Do.
Renville	(2)	457,233	Stone, sand and gravel.
Rice	45,589	61,769	Sand and gravel.
Rock	203,100	297,604	Sand and gravel, abrasives, stone.
Roseau	6,831	(2)	Sand and gravel.
St. Louis	394,994,930	240,519,989	Iron ore, cement, sand and gravel, lime, stone.
Scott	304,209	455,473	Stone, sand and gravel.
Sherburne		17,632	Sand and gravel.
Sibley		(2)	Do.
Stearns	1,365,282	1,981,911	Stone, sand and gravel.
Steele	188,544	549,638	Sand and gravel, stone.
Stevens		29,751	Sand and gravel.
Swift	6,259	91,982	Do.
Todd	3,976	96,943	Do.
Wabasha	7,832	6,025	Do.
Wadena		24,332	Do.
Washington	(2)	1,192,361	Do.
Watonwan	17,305	110,722	Do.
Wilkin	(2)	42,349	Do.
Winona	413,312	487,494	Stone, sand and gravel, clays.
Wright	116,418	897,442	Sand and gravel.
Yellow Medicine	197,885	(2)	Stone, sand and gravel.
Undistributed	1,591,917	7,089,454	
Total	542,545,000	351,475,000	

[1] The following counties are not listed because no production was reported: Carver, Clearwater, Hubbard Koochiching, Red Lake, Traverse, and Waseca.
[2] Value included with "Undistributed."

Blue Earth.—Guaranteed Gravel & Sand Co. and North Star Concrete Co., both of Mankato, produced sand and gravel for building and road use. Hiniker Sand & Gravel Co. of North Mankato reported the production of sand and gravel for building purposes. Lundin Construction Co. produced limestone for riprap, roadstone, and agricultural use.

Brown.—A. C. Ochs Brick & Tile Co., Springfield, produced clay used in the manufacture of common brick and heavy clay products. Math N. Schumacher, Springfield; Wallner Construction Co., New Ulm; Roberts Bros. and M. M. Youngman, both of Sleepy Eye, produced sand and gravel, mostly for building and road use. Road gravel was produced by and for the county highway department.

Carlton.—Sand and gravel for building and road use was produced by Albert Obraske, Moose Lake; and White & Almer, Cloquet. Gravel for railroad ballast and other uses was produced by the Great Northern Railway Co. and Minneapolis, St. Paul & Sault Ste. Marie Railroad Co. The county highway department produced and contracted for road gravel. The Nemadji Tile & Pottery Co., Moose Lake, produced fire clay for use in art pottery and high-grade tile. Clay for common brick and heavy clay products was reported sold by the Wrenshall Brick Co. of Duluth.

Cass.—Gravel for road use was produced by and for the county highway department. The United States Army Corps of Engineers also contracted for road gravel.

Chippewa.—The Melrose Granite Co. produced dimension granite for monumental purposes. Sand and gravel for building and road use was produced by the Hallett Construction Co. (Crosby) and

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Sandberg Construction Co. (Maynard). Road gravel was produced under contract for the Kandiyohi County Highway Department.

Chisago.—Hallett Construction Co. produced sand and gravel for building and road use and railroad ballast. Ed Lundin (Mankato), P. O. Pederson, Inc. (North Branch), and the county highway department produced road gravel.

Clay.—Sand and gravel produced in Clay County in 1954 was used principally for building and road construction. Operators who reported production were: Kost Bros. Inc., Thomson Bros., and Twin City Sand & Gravel Co., Hawley; and Rollo Lewis, Fargo, N. Dak. Road gravel was produced for the county highway department.

Cook.—Road gravel was produced under contract for the United States Department of Commerce and the county highway department. The latter also produced gravel for road use.

Work progressed at Taconite Harbor, where Erie Mining Co. was constructing harbor and dock facilities for the transportation of iron-ore pellets, which will be produced by the company at its new taconite plant under construction near Aurora. Shipments of pellets from Taconite Harbor are expected to begin in 1957.

Cottonwood.—Windom Sand & Gravel Co., Windom, produced sand and gravel for building and miscellaneous purposes. Road gravel was produced under contract for the Jackson County Highway Department.

Crow Wing.—Iron-ore shipments in 1954 totaled 1,708,893 long tons compared with 2,734,345 long tons in 1953. Companies which shipped iron ore in 1954 were:

Company:	*Mines operated*
Dates Mining Co	Pennington.
M. A. Hanna Co	Portsmouth group, North Yawkey.
Hanna Coal & Ore Corp	Feigh, Huntington, Louise, Maroco, Section No. 6, Snowshoe, and South Hillcrest.
Inland Steel Co	Armour No. 1, and No. 2.
Pickands Mather & Co	Mahnomen and Rabbit Lake.
Zontelli Bros., Inc	Manuel and Virginia (incl. South Yawkey).

Rhude & Fryberger began stripping operations at the Carlson-Nelson reserve near Riverton.

Shipments of manganiferous ore were reported by Hanna Coal & Ore Corp. from the Alstead group; Pickands Mather & Co. from the Mahnomen and Sagamore mines; and Zontelli Bros., Inc., from the Joan mine and the Merritt stockpile.

Manganese carbonate, manganese dioxide, and other manganese products were produced in 1954 by Manganese Chemicals Corp. at its chemical plant at Riverton. Ore used at the plant was purchased chiefly from Zontelli Bros., Inc., from the Merritt stockpile. The capacity of the plant was approximately 200 tons of crude ore input per day.

Gravel for building and road use was produced in the county by Anderson Bros., Brainerd; Joe Mirau, Deerwood; and the county highway department.

Tweed Bros., Pequot Lakes, produced marl for agricultural use.

Dakota.—J. L. Shiely Co., St. Paul, produced limestone for use as riprap, rubble, rough construction, roadstone, agricultural lime,

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railroad ballast, and flagging." The Twin City Brick Co., St. Paul, produced clay for common brick and heavy clay products. Producers of sand and gravel in the county included: Bituminous Surface Treating Co., Minneapolis; Standard Building Materials Co., Inc., St. Paul; Emil Hanson, Farmington; and Edw. M. Hustings, Hastings. The output was chiefly for building and road use. The United States Army Corps of Engineers contracted for the production of road gravel.

Faribault.—Road gravel was produced by Carlson Construction Co., Comfrey; Clarence Zufall, Elmore; and for the county highway department. Fairbault Quarries produced crushed limestone for use as roadstone.

Fillmore.—In 1954 Hanna Coal & Ore Corp. shipped 150,512 long tons of iron-ore concentrate from its group of open-pit operations near Spring Valley, compared with 230,425 long tons in 1953. Shipments were all by rail to steel mills in Illinois.

Crushed limestone was produced during the year by Hadland & Vreeman, Ostrander; Pederson Bros., Harmony; Siegmiller Construction Co., Decorah, Iowa; and the county highway department. Uses reported were for roadstone and agricultural lime.

Freeborn.—Sand and gravel for building and road use, railroad ballast, and other uses was produced by N. J. Nelson & Son, Clarks Grove; and Emil Olson & Sons, Albert Lea. The county highway department produced and contracted for road gravel.

Goodhue.—The Mann Construction Co. (Red Wing) and Valley Construction Co. (Zumbrota) produced crushed or broken limestone for use as riprap, roadstone, and agricultural lime. Sand and gravel for building and road use was produced by Harry M. Berktold and Arthur Mickow, both of Lake City; Hallett Construction Co., Crosby; Munson Construction Co., Cannon Falls; and the city of Red Wing. Sand and gravel for road purposes was produced under contract for the county highway department. Clay for use in manufacturing heavy clay products was produced by the Red Wing Sewer Pipe Corp.

Grant.—Sam Olson, Elbow Lake, produced sand for building purposes. The Minneapolis, St. Paul & Sault Ste. Marie Railroad produced gravel for railroad ballast and other purposes.

Hennepin.—Sand and gravel was produced in the county for a variety of purposes, including building, paving and road use, filter sand, and miscellaneous uses. Operators in the Minneapolis area included Anderson Aggregates Co., Barton Contracting Co., Concrete Service Inc., Glacier Sand & Gravel Co., F. W. Hedberg & Sons Inc., Industrial Aggregate Co., Keller Bros. Gravel Co., Landers-Norblom-Christenson Co., Mapco Sand & Gravel Co., Minnesota Sand and Gravel Co., Oscar Roberts Co., Earl A. Sewall Co., Inc., and Clarence R. Storm. The county highway department produced gravel for road use. Landers-Norblom-Christenson Co. also produced limestone for use as roadstone, agricultural lime, asphalt filler, roofing, and rubble. Crude perlite was expanded in Minneapolis by the Western Mineral Products Co. for use as a lightweight aggregate in plaster and concrete.

Houston.—Botcher Bros. (Houston) and Hector Construction Co. and Heintz & Smith (both of Caledonia) produced limestone for riprap, roadstone, and agricultural use. Road gravel was produced

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under contract for the county highway department and for the city of Red Wing.

Itasca.—Iron ore was the chief mineral product of the county. Shipments of usable iron ore in 1954 totaled 10,715,333 long tons, which included 727,731 tons of direct-shipping grade and 9,987,602 tons of concentrate, compared with a total of 16,454,297 long tons shipped in 1953. Operating companies and mines from which iron ore was shipped in 1954 were:

Company:	*Mines operated*
Butler Bros	Galbraith, Harrison group, Patrick "A" group, Patrick "B" group, Patrick "C," Wyman group.
Cleveland-Cliffs Iron Co	Canisteo, Hawkins (incl. MacKillican), Hawkins Tailings Plant, Hill-Trumbull, Holman-Cliffs, Sargent.
M. A. Hanna Co	Buckeye, Mississippi group.
Hanna Coal & Ore Corp	Argonne, Carlz No. 2, Leach, Perry.
Jones & Laughlin Steel Corp	Hill Annex.
Oliver Iron Mining Division, U. S. Steel Corp.	Gross Marble, King, Plummer.
Pacific Isle Mining Co	York.
Pickands Mather & Co	Bennett, Danube, West Hill.

The first shipments of iron ore were made in September from the Plummer open-pit mine, operated by Oliver Iron Mining Division of United States Steel Corp. The mine has been under development since 1952.

At the end of the 1954 shipping season operations at the Buckeye mine of M. A. Hanna Co. were suspended indefinitely.

Sand and gravel was produced by Hawkinson Construction Co., Grand Rapids; Mesaba Construction Co., Hibbing; and the county highway department. The material was used chiefly for building and road construction.

Jackson.—Sand and gravel for building and road use was produced by Schroeder Construction Co., Heron Lake; Willett Gravel Co., Jackson; and the county highway department. Road gravel was also produced under contract for the county highway department.

Kanabec.—Granite for building and monumental purposes was produced by the Cold Spring Granite Co., Cold Spring, from the Mora Grey quarry. Lindquist, Olson & Co., Cambridge, produced road gravel.

Kandiyohi.—Atwater Sand & Gravel (Atwater), New London Materials & Construction Co. (New London), and the Great Northern Railway Co. produced sand and gravel, used mostly for building, roads, and railroad ballast. Road gravel was also produced by and for the county highway department.

Lac qui Parle.—The Cold Spring Granite Co. and the Unique Granite Co. produced granite for building and monumental purposes. Sand and gravel for building and road construction was produced by the Hallett Construction Co. (Crosby) and Sisson's Washed Sand & Gravel (Montevideo). Road gravel was produced by and for the county highway department.

Lake.—Construction work progressed at Silver Bay, site of Reserve Mining Co. Harbor, taconite plant, and townsite development on the north shore of Lake Superior. Initial annual capacity of the plant, called the E. W. Davis Works, was expected to be 3.75 million tons

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of iron-ore pellets. Provision has been made for an eventual annual production capacity of 10 million tons of pellets. The taconite mine of Reserve Mining Co. is 47 miles inland from Silver Bay near Babbitt. Operation of the E. W. Davis Works will be year-round, with pellets stockpiled during the winter months.

The Lake County Highway Department produced gravel for road use.

Le Sueur.—Dimension limestone for building use was produced by the Babcock Co., Kasota. The company marketed a portion of its production as marble, actually a highly polished limestone, for interior trim and facings. The Silica Sand Corp., Le Sueur, produced silica sand for filter purposes from the Jordan Sandstone formation. Gravel for building use, road construction, railroad ballast, and other purposes was produced by C. C. Cram, Waterville; Glander Washed Sand & Gravel Co. and Zarnott Construction Co., both of Gaylord; E. G. Sutter, Waseca; Ed Swartout, Mankato; and the Chicago, St. Paul, Minneapolis & Omaha Railroad.

Lincoln.—Building sand was produced by the Tyler Cement Tile & Silo Works, Tyler. Road gravel was produced by and for the county highway department.

Lyon.—Deutz & Crow and Marshall Sand & Gravel Co., both of Marshall, produced sand and gravel, chiefly for building and road construction.

Marshall.—The Bjorgaard gravel pit produced road gravel near Argyle. Road gravel was also produced under contract for the county highway department.

McLeod.—Sand and gravel for road construction was produced near Glencoe by the Bullert Construction Co. and Clarence Reed. The county highway department contracted for sand and gravel for road use.

Meeker.—Sand and gravel, used mostly in the building trade and in road construction, was produced by Grove City Surfacing Co., Inc., Grove City; Wolters Washed Sand, North Litchfield; and Hallett Construction Co., Crosby.

Mille Lacs.—The Cold Spring Granite Co. produced granite for building and monumental purposes from the Diamond Grey quarry near Isle. Mille Lacs Sand & Gravel, Milaca, produced sand and gravel for building and road purposes and miscellaneous uses. Road gravel was produced by Edw. J. Hines, Wahkon; and Lindquist, Olson & Co., Cambridge.

Mower.—Osmundson Bros. (Adams) and Hickok Calcium White Rock Co. (Le Roy), produced crushed limestone. Uses were for roadstone, agricultural lime, flux, mineral food, and poultry grit. The Austin Ready Mix Concrete Co., Austin, produced building sand and road gravel. The county highway department contracted for road gravel.

Nicollet.—Sand and gravel for building and road use was produced by Delphin Anderson, Lafayette; and the Hallett Construction Co., Crosby. Road gravel was produced by A. H. & J. H. Massopust and under contract for the county highway department.

Nobles.—Worthington Sand Co., Worthington, produced gravel for building use. Road gravel was produced by the Carlson Con-

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struction Co., Comfrey, and by and for the county highway department.

Olmsted.—Patterson Quarries (St. Charles) and Clarence Paulson (Rochester), produced limestone for use as rubble, roadstone, and agricultural lime. Rochester Sand & Gravel Co. produced sand and gravel from a pit in Cascade Township near Rochester. Output was used mostly for building purposes.

Otter Tail.—John Dieseth Co. and Mark Sand & Gravel Co. (Fergus Falls), Edner Sand & Gravel (Campbell), and the city of Fergus Falls produced sand and gravel for building and road construction.

Pine.—Louis Hultgren & Sons, Kerrick, produced molding sand. Yost Bros., Pine City, produced sand and gravel for building use. H. T. Smith of Hixton, Wis., produced road gravel.

Pipestone.—Hallett Construction Co., Crosby, produced sand and gravel for building use at its Woodstock plant. The Chicago, Milwaukee, St. Paul & Pacific Railroad Co. produced gravel, mostly for railroad ballast.

Polk.—The Red River Valley Brick Corp. of Grand Forks, N. Dak., produced clay near Fertile. Sand and gravel producers included Ahles & Lush and Spring Gravel Co., Crookston; Thorson Gravel Co., Fertile; and the Great Northern Railway Co. Output was for building and road purposes, railroad ballast, and miscellaneous uses.

Pope.—Starbuck Cement Products Co., Starbuck, produced sand and gravel for building and road purposes. The county highway department produced road gravel.

Ramsey.—The Ford Motor Co. mined silica sand from the St. Peter sandstone formation underlying its property in St. Paul. The material was used in its glass plant. Ed. Heaton, St. Paul, also produced silica sand for foundry use. Craig J. Alexander and the city of St. Paul produced road gravel.

Redwood.—Chapman Gravel Co. (Echo) and John Harms Sand & Gravel (Walnut Grove), produced sand and gravel for building and road use. M. A. Wilson, Redwood Falls, produced road gravel.

Renville.—The Cold Spring Granite Co. produced dimension granite for building and monumental use and crushed granite for roadstone and poultry grit. The Melrose Granite Co. produced dimension granite for monumental purposes. Danube Washed Sand & Gravel Co., Danube, produced sand and gravel for building and road purposes. Road gravel was produced by Anderson & Larson, Fairfax, and under contract for the Kandiyohi County Highway Department.

Rice.—Sand and gravel for building and road construction was produced by Concrete Materials Inc., Fairfield; Cleland Construction Co., Northfield; and E. G. Sutter, Waseca. Road gravel was produced for the county highway department.

Rock.—Grinding pebbles and tube-mill liners were produced by the Jasper Stone Co. from a quartzite deposit near Jasper. Waste material from the operation was sold chiefly for use as riprap. Sand and gravel for building and road use was produced by Hallett Construction Co., Crosby; C. H. Hatling Gravel Co., Luverne; and Pronk Bros., Edgerton.

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Roseau.—Ole Holland produced gravel for building use near Roseau. The county highway department produced sand and gravel for building and road use. Road gravel was also produced under contract for the county highway department.

St. Louis.—Production of cement, iron ore, lime, sand and gravel, and stone was recorded in St. Louis County in 1954. Iron ore, in value, represented over 97 percent of the total mineral production in the county. St. Louis County also furnished 74 percent of the total usable iron ore shipments from mines in the State in 1954. Operating companies and mines, mine groups, and plants from which shipments were reported in 1954 were as follows:

Company:	*Mines operated*
Butler Bros	Agnew No. 2, North Eddy, South Agnew, Weggum-South Longyear.
Charleson Iron Mining Co	Charleson concentrator.
Cleveland-Cliffs Iron Co	Agnew-Alworth.
E. W. Coons Co	Genoa-Sparta, Lincoln "D," Sidney, South Julia, Victoria.
Douglas Mining Co	Douglas, Duncan.
Haley-Young Mining Co	Elbern.
M. A. Hanna Co	Brunt, Enterprise (incl. Sauntry), Impro "B," Norpac, Pillsbury Addition, Section No. 18.
Jones & Laughlin Steel Corp	Columbia (incl. Missabe Mountain), Longyear, Sauntry, Wentworth.
W. S. Moore Co	Gilbert Sliver, Hanna, Judson Lease, Knox, Margaret, Norman, Pilot, Pilot Annex, Prindle, Prindle stockpile, Stubler, Yawkey.
Morton Ore Co	Morton.
North Range Mining Co	Leonidas.
Oglebay, Norton & Co	St. James-Canton.
Oliver Iron Mining Division, U. S. Steel Corp.	Canton group, Fayal, Fraser, Gilbert, Godfrey, Hull-Rust group, Monroe group, Mountain Iron group, Pillsbury, Pilotac, Pioneer, Rouchleau group, Sherman group, Sibley, Soudan, Spruce.
Pacific Isle Mining Co	Bradford, Cyprus-Rust, Dunwoody, Graham No. 2, Lamberton, Missabe Mountain LOSP, Missabe Mountain South Lease, North Shiras, Pacific Fee, Shiras, South Uno (N. P.), Wacootah.
Pickands Mather & Co	Albany, Biwabik, Carmi-Carson Lake, Corsica, Embarrass, Erie Preliminary taconite plant, Mahoning groups 1, 2, 3, 4, and 6, Scranton, Zenith.
Pioneer Mining Co	Mary Ellen.
Pittsburgh Pacific Co	Alpena, Chataco, Sliver LOSP.
Range Mining & Contracting Co.	Atkins.
Republic Steel Corp	Stevenson, Susquehanna, Union LOSP.
Reserve Mining Co	Babbitt taconite plant.
Rhude & Fryberger	Boeing, Troy.
Rhude-Gilbert Corp	Alworth O. P.
Skubic Bros. Co	Ernie.
Snyder Mining Co	Webb-Sellers Triangle, Whiteside.
E. A. Young, Inc	Minnewas.

Development of Minnesota's new magnetic taconite industry in the county continued during the year. Reserve Mining Co., owned jointly by Republic Steel Corp. and Armco Steel Co., has been producing taconite pellets at its preliminary plant near Babbitt since

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1952. This plant, with an annual capacity of 300,000 tons of finished product, has been the pilot plant for the large-scale commercial plant, the E. W. Davis Works, under construction at Silver Bay in Lake County. Initial annual capacity of this plant was expected to be 3.75 million tons of taconite pellets, with provision made for an ultimate yearly capacity of 10 million tons. Reserve's taconite mine is near Babbitt, 47 miles inland from Silver Bay. The ore body was estimated to contain at least 1.5 billion tons of magnetic taconite, which will yield approximately 500 million tons of concentrate containing 60 to 63 percent iron.

Erie Mining Co. made substantial progress in developing its mine and constructing its large commercial taconite plant near Aurora. The plant will have an initial rated annual capacity of 7.5 million tons of finished product with an ultimate planned capacity of 10.5 million tons. Pellets will be hauled from the plant over the company 73-mile railroad to Taconite Harbor, where the company has been constructing dock and harbor facilities. The plant was expected to be ready for operation in 1957. Erie Mining Co. has been producing taconite pellets at its Erie preliminary taconite plant near Aurora since 1948. The firm is owned by Bethlehem Steel Corp., Youngstown Sheet & Tube Co., Interlake Iron Corp., and the Steel Co. of Canada. Pickands Mather & Co. is the operating agent for Erie Mining Co.

The largest producer of taconite concentrate in 1954 was the Oliver Iron Mining Division of United States Steel Corp., which operated its Pilotac plant and taconite mine near Mountain Iron. Shipments were first recorded from this new operation in 1953. The annual capacity of the Pilotac plant was about 500,000 tons of concentrate of high iron content. Concentrate produced at the Pilotac plant was hauled approximately 6 miles by rail to Oliver's Extaca plant at Virginia for agglomeration.

The Morton mine near Hibbing has again joined the ranks of shipping mines, after a 4-year period of stripping operations during which approximately 25 million cubic yards of overburden has been removed. The mine, previously worked by underground mining methods, was operated by M. A. Hanna Co., agent for the Morton Ore Co.

North Range Mining Co. has reopened the Leonidas underground mine near Eveleth under a sublease from Oliver Iron Mining Division of United States Steel Corp. The mine, inactive since 1947, was once the largest producer among the underground mines in Minnesota.

First shipments of iron ore were recorded in 1954 from the Gilbert Sliver mine, operated by W. S. Moore Co. near Gilbert in the Mesabi range.

Oliver Iron Mining Division of United States Steel Corp. ceased underground mining at the Fraser mine in the Mesabi range.

Cement was produced by the Universal Atlas Cement Co. at Duluth. Shipments increased slightly over 1953.

The Cutler-Magner Co. produced quicklime and hydrated lime at its Duluth plant for building, agricultural, industrial, and chemical uses. The value of sales increased slightly over 1953, although the quantity shipped in 1954 was less than in the preceding year.

Rough granite for monumental use was produced by the Mesaba Granite Co. from a quarry near Mountain Iron.

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Sand and gravel for a variety of purposes, including building and road construction, railroad ballast, engine sand, and other uses, was produced in the county in 1954. Producers during the year included Arrowhead Sand & Gravel Co., Duluth; Biwabik Gravel Co., Biwabik; Northwest Gravel & Excavating Co., Virginia; E. W. Coons Co. and Enrico Ghilardi, Hibbing; Hallett Construction Co., Crosby; Ed Lundin, Mankato; Duluth, Missabe & Iron Range Railway Co.; and the Great Northern Railway Co. The St. Louis County Highway Department produced and contracted for sand and gravel for road use. The city of Superior, Wis., produced road gravel from a pit in St. Louis County.

Scott.—Bryan Rock Products, Inc., Shakopee, produced crushed or broken limestone for riprap, roadstone, and agricultural lime. Sand and gravel produced in the county was used chiefly for building and road construction. In addition, blast sand was produced by the Minnesota Quartz Co. at Mendota from sand mined in Scott County. Sand and gravel producers during the year included Belle Plaine Sand Co., Belle Plaine; Haferman & Stark, Prior Lake; Hallett Construction Co., Crosby; Lubansky Bros., Chaska; Minnesota Quartz Co., Mendota; and the Shakopee Sand & Gravel Co., Shakopee. The county highway department produced road gravel and also contracted for road sand.

Stearns.—Dressed dimension granite for building or monumental purposes was produced by the Cold Spring Granite Co., Melrose Granite Co., and the North Star Granite Corp. All three companies operated finishing plants within the county. Crushed granite for roadstone and railroad ballast was produced by Shiely-Petters Crushed Stone Co. Sand and gravel for building use was produced by Megarry Bros. and A. C. Petters Inc., both of St. Cloud.

Steele.—Sand and gravel operators during the year included George Kohlmier, Inc., and Owatonna Aggregates Corp., Owatonna; and the Medford Washed Sand & Gravel Co., Medford. Output was for building and road construction. Road gravel was produced in the county under contract for the highway departments of both Freeborn and Steele Counties. The Klemmer Construction Co., Owatonna, produced limestone for use as rubble, roadstone, and agricultural lime.

Swift.—Neale G. Evans (Appleton), the Chicago, Milwaukee, St. Paul & Pacific Railroad Co., and the Great Northern Railway Co. produced gravel, chiefly for railroad ballast, building and road purposes. Road gravel was also produced by and for the county highway department.

Wabasha.—The Chicago, Milwaukee, St. Paul & Pacific Railroad Co. produced gravel for its own use. Road gravel was produced under contract for the county highway department.

Wadena.—Sand and gravel, chiefly for building and road purposes, was produced near Wadena by the Becker County Sand & Gravel Co., Crosby.

Washington.—Over a million tons of sand and gravel was produced in the county in 1954. Operators during the year included J. L. Shiely Co., Cemstone Products, Inc., and Certified Aggregates Inc., all of St. Paul; Moelter Construction Co., Stillwater; and Shalander &

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Shaleen, Scandia. Material produced was for building and road construction and engine use. Road gravel was produced for the county highway department.

Watonwan.—Road gravel was produced by George Allen, Madelia; Carlson Construction Co., Comfrey; and by and for the county highway department.

Winona.—The Biesanz Stone Co., produced sawed and cut limestone for building purposes. Fred Fakler produced crushed limestone for roadstone and agricultural lime. Clay was produced by the Biesanz Brick Yards for manufacturing common brick. The Winona Sand & Gravel Co. produced sand and gravel for building and road construction. Sand for road use was produced under contract for the county highway department.

Wright.—Sand and gravel was produced in the county by Fairway Construction Co., Hector; Ed. Schram, South Haven; and Charles and Anna Frank, Delano. Road gravel was also produced by and for the county highway department. The Delano Granite Works, Inc. operated a sawing and finishing plant at Delano.

Yellow Medicine.—The Great Northern Railway Co. produced granite for use as rubble and railroad ballast. Burdett C. Long produced gravel for road use.

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The Mineral Industry of Mississippi

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, United States Department of the Interior, and the Geological Survey of Mississippi.

By Robert S. Sanford,[1] William C. Morse,[2] and Harvard Eng[3]

THE VALUE of mineral production in Mississippi increased 2 percent and exceeded $110 million in 1954. Fuels composed 90 percent of the total and construction materials and clays the remaining 10 percent. Petroleum represented 86 percent of the fuel production and 77 percent of the State's total mineral production (fig. 1). Other important minerals produced were sand and gravel, clays, stone, and cement. Mississippi produced 14 percent of the Nation's bentonite output during 1954.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences of coverage.

TABLE 1.—Mineral production in Mississippi, 1953–54[1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	[2] 560,047	[2] $3,158,385	559,401	$3,103,132
Natural gas ..... million cubic feet	154,254	12,340,000	140,448	11,657,000
Natural-gas liquids:				
Natural gasoline and cycle products ..... thousand gallons	32,214	2,295,000	27,804	1,944,000
LP-gases ..... do	17,724	713,000	15,288	528,000
Petroleum (crude) ..... thousand 42-gallon barrels	35,620	84,060,000	34,240	85,600,000
Sand and gravel	2,653,646	2,173,871	5,441,837	4,286,871
Stone	38,000	43,700	[3] 181,418	[3] 181,418
Undistributed: Nonmetallic minerals		3,083,749		3,352,481
Total		107,868,000		[4] 110,563,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes value of clays used for cement.
[3] Final figure, supersedes preliminary figure given in commodity chapter.
[4] The total has been adjusted to eliminate duplication in the value of clays and stone.

CONSUMPTION AND MARKETS

Refineries processed Mississippi crude oil; natural-gas cycling plants processed gas for condensate; brick and other heavy clay industries

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utilized clays; fuller's earth was processed for absorbent uses. Bentonite was exported to other States and countries for use as binder in refractories and for filtering, clarification of oil, fillers, drilling muds, and other uses. Road and construction companies consumed sand and gravel. Mississippi utilized limestone for agricultural purposes and cement.

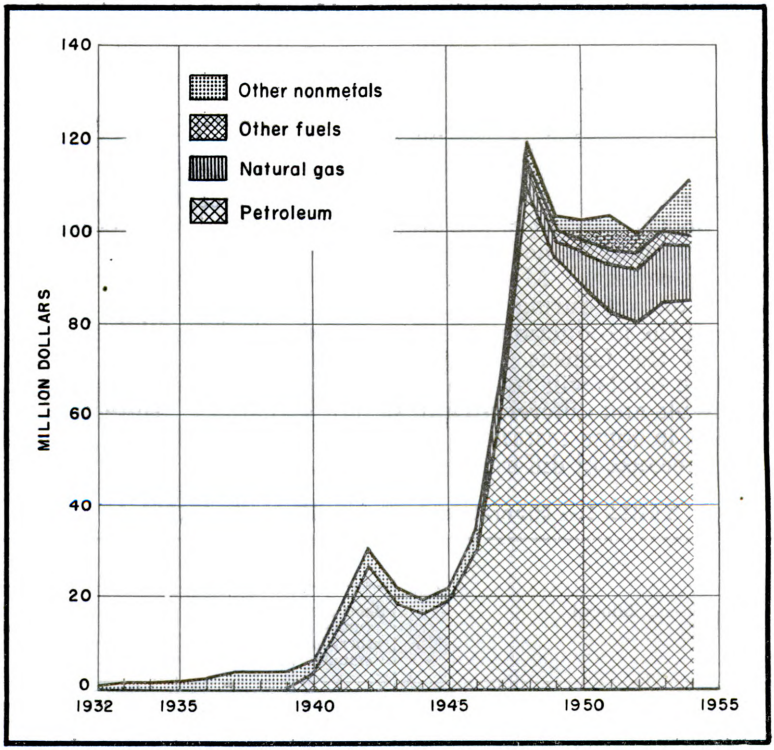

FIGURE 1.—Value of mineral production in Mississippi, 1932–54.

TABLE 2.—Average unit value of mineral commodities produced in Mississippi, 1950–54

Commodity		1950	1951	1952	1953	1954
Cement	376-pound barrel			$2.53	$2.71	$2.69
Clays:						
Ball clay	short ton	$15.25	$15.01	14.90	14.57	15.13
Bentonite	do.	5.68	9.73	7.89	10.72	10.77
Fire clay	do.	1.68	1.83	1.61	1.69	1.61
Fuller's earth	do.	39.18	41.04	43.65	41.94	36.80
Miscellaneous clay	do.	.92	1.02	1.08	1.06	1.06
For cement manufacture	do.		1.00	1.00	1.00	
Gravel	do.	.81	.81	.85	.87	.81
Natural gas	thousand cubic feet	.06	.06	.06	.08	.08
Natural-gas liquids:						
Natural gasoline and cycle products	42-gallon barrel	2.92	3.43	3.25	2.99	2.94
LP-gases	do.	1.62	1.80	1.66	1.69	1.45
Petroleum	do.	2.31	2.24	2.23	2.36	2.50
Sand	short ton	.55	.64	.66	.71	.74
Stone:						
Limestone (crushed)	do.	1.15	1.15	1.15	1.15	1.00
Miscellaneous (crushed)	do.		.40			

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EMPLOYMENT AND INJURIES

Employment in the mining industry remained relatively stable, with an average of 3,100 people monthly.[4]

No fatal accidents occurred in the nonmetallic industries in 1954.

The oil and gas industry employed 2,930 men, for a total of 6,287,568 man-hours, and had 1 fatal accident and 61 nonfatal accidents.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The first recorded production of petroleum and/or natural gas in Mississippi was in 1933.[5] Since that date production has increased rapidly, until in 1954 the value of liquid fuels was $99.7 million. In 1954 the State had 2,173 wells that produced an average of 45.5 barrels per day—an increase of 223 wells over 1953. Oil production was reported from 28 of the State's 82 counties; and 34 percent of the State's total land area was productive or leased.[6] Well completions in 1954 totaled 445, or 79 more than in 1953. Of the 263 proved-field wells, 127 were oil, 31 gas, and 105 dry. Of the 182 exploratory wells, 16 were oil, 3 gas, and 163 dry, a discovery success of 1 in 9.5 exploratory wells drilled. Of the 13 new fields discovered, 11 were oil and 2 gas or gas-condensate. As a result of exploratory and development drilling, proved reserves of liquid fuels increased crude oil 18 percent, natural gas 8 percent, natural-gas liquids 10 percent, and liquid hydrocarbons 17 percent.

Natural Gas.—Mississippi was the 9th largest natural-gas producer in the Nation in 1954. The marketed production of natural gas decreased 9 percent in quantity and 6 percent in value from 1953. Gross withdrawal of natural gas was 237,000 million cubic feet, of which gas wells accounted for 167,000 million cubic feet and oil wells the remaining 70,000 million cubic feet. Marketed production accounted for 140,448 million cubic feet, and repressuring 58,645 million cubic feet; 37,907 million cubic feet was wasted or vented. Natural gas for consumption was transmitted both in and out of the State. Counties leading in natural-gas production in 1954 were Jefferson Davis, Lamar, and Simpson. The California Co. operated 2 natural-gasoline plants, 1 at Brookhaven, Lincoln County, the other at Cranfield, Adams County. Southern Natural Gas Co. operated a natural-gasoline and cycling plant, using the absorption process, at Gwinville in Jefferson Davis County.

Natural-Gas Liquids.—The production of natural-gas liquids decreased 14 percent, and the value decreased 18 percent to $2,472,000 from 1953. Natural gasoline and cycle products declined 14 percent in quantity and 15 percent in value from 1953.

Petroleum.—Although the production decreased 4 percent to 34 million barrels from 1953, the value increased 2 percent to $86 million, as the average price of crude oil rose from $2.36 to $2.50 per barrel. The indicated demand for crude petroleum decreased approximately 2 percent to 35 million barrels in 1954.

[4] Mississippi Employment Security Commission, Jackson, Miss., Mimeographed Release: 1954.
[5] American Petroleum Institute, Petroleum Facts and Figures: 11th ed., 1954, p. 115.
[6] National Oil Scouts and Landmen's Association, Oil and Gas Field Development in United States; Year Book 1955 (Review 1954): Vol. 25, 1955, p. 445.

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TABLE 3.—Well completions by counties in 1954 [1]

County	Proved field or development wells			Exploratory wells			Total proved field or exploratory wells			Grand total
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	
Adams	45	2	44	1		41	46	2	85	133
Amite						1			1	1
Bolivar						1			1	1
Calhoun						3			3	3
Clarke						1			1	1
Copiah						1			1	1
Forrest	2	17	2			1	2	17	3	22
Franklin	13		10	2		10	15		20	35
George						7			7	7
Greene						2			2	2
Hancock						3			3	3
Hinds	4		5	3		3	7		8	15
Holmes						1			1	1
Issaquena						1			1	1
Itawamba						4			4	4
Jackson						2			2	2
Jasper	22		2				22		2	24
Jefferson	17		13	2		30	19		43	62
Jones	8		2	1		2	9		4	13
Kemper						2			2	2
Lamar						2			2	2
Leake						1			1	1
Leflore						1			1	1
Lincoln	1		4	1			2		4	6
Madison				1	1	3	1	1	3	5
Marion			1			1			2	2
Monroe		2	3		1	3		3	6	9
Pearl River	1	7	4		1	3	1	8	7	16
Perry				1		1	1		1	2
Pontotoc						3			3	3
Prentiss						1			1	1
Sharkey			1						1	1
Simpson		3	1					3	1	4
Smith	1			1			2			2
Stone						1			1	1
Sunflower						2			2	2
Tishomingo						1			1	1
Union						1			1	1
Washington						1			1	1
Wayne	4		2			10	4		12	16
Wilkinson	9		11	3		9	12		20	32
Yazoo						3			3	3
Total:										
1954	127	31	105	16	3	163	143	34	268	445
1953	106	24	73	16	5	142	122	29	215	366

[1] National Oil Scouts & Landmen's Association, Oil and Gas Field Development in United States, Year Book 1955 (Review 1954): Vol. 25, 1955, p. 461.

TABLE 4.—Estimated proved reserves of crude oil, natural-gas liquids, and natural gas [1]

	Proved reserves, Dec. 31, 1953	Changes in proved reserves, due to extensions and new discoveries	Proved reserves, Dec. 31, 1954, (production was deducted)	Change from 1953, percent
Crude oil ..... 42-gallon barrels..	350, 101, 000	94, 830, 000	412, 276. 000	+18
Natural gas liquids [2 3] ..... do	54. 734. 000	8, 412, 000	60, 420, 000	+10
Natural gas [3] ..... million cubic feet..	2, 569, 181	370, 017	2, 772, 683	+8

[1] Proved Reserves of Crude Oil, Natural-Gas Liquids, and Natural Gas; American Gas Association and American Petroleum Institute: Vol. 9, Dec. 31, 1954, pp. 1-22.
[2] Includes condensate, natural gasoline, and LP-gases.
[3] Proved recoverable reserves.

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TABLE 5.—Marketed production of natural gas, 1945–49 (average) and 1950–54

Year	Million cubic feet	Value	Year	Million cubic feet	Value
1945–49 (average)	35,962	[1] $2,014,400	1952	174,100	$10,620,000
1950	114,153	7,192,000	1953	154,254	12,340,000
1951	158,845	10,007,000	1954	140,448	11,657,000

[1] Production of natural gas did not become significant until 1947.

TABLE 6.—Gross withdrawals and disposition of natural gas, 1950–54, in million cubic feet

Year	Withdrawals [1]			Disposition		
	From gas wells	From oil wells	Total	Marketed production [2]	Repressuring	Vented and wasted [3]
1950	120,430	40,760	161,190	114,153	42,334	4,703
1951	175,500	83,400	258,900	158,845	41,718	58,337
1952	184,200	81,500	265,700	174,100	47,605	43,995
1953	180,000	75,000	255,000	154,254	53,223	47,523
1954	167,000	70,000	237,000	140,448	58,645	37,907

[1] Marketed production plus quantities used in repressuring, vented, and wasted.
[2] Comprises gas sold or consumed by producers, including losses in transmission, amounts added to storage and increases in gas in pipelines.
[3] Includes direct waste on producing properties and residue blown to air (partly estimated).

TABLE 7.—Natural-gas liquids produced, 1950–54, in thousand gallons

Year	Natural gasoline		LP-gases		Total	
	Thousand gallons	Value	Thousand gallons	Value	Thousand gallons	Value
1950	32,760	$2,274,000	22,344	$864,000	55,104	$3,138,000
1951	30,618	2,503,000	19,866	852,000	50,484	3,355,000
1952	33,726	2,606,000	19,614	777,000	53,340	3,383,000
1953	32,214	2,295,000	17,724	713,000	49,938	3,008,000
1954	27,804	1,944,000	15,288	528,000	43,092	2,472,000

There were 2,173 producing wells in Mississippi, with an average daily production per well of 45.5 barrels. The number of wells drilled rose 18 percent from 1953. Baxterville was the largest producing field in 1954, followed closely by Tinsley. Other important fields were Brookhaven, Heidelburg, and La Grange.

Paluxy Asphalt Co. operated a skimming and cracking refinery at Crupp in Yazoo County. Southland Co. operated a skimming refinery at Sandersville in Jones County.

Pipelines,—The 1954 oil production was gathered by seven pipeline companies. Interstate Oil Pipe Line constructed 32.25 miles of 8-inch pipeline from Gwinville to Soco. Tennessee Gas Transmission constructed 228 miles of 30-inch pipeline from Lake Providence to Corinth.

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TABLE 8.—Production of crude petroleum, 1945–49 (average) and 1950–54

Year	Thousand 42-gallon barrels	Value	
		Total	Average per barrel
1945–49 (average)	32,402	$62,904,000	$1.94
1950	38,236	88,330,000	2.31
1951	37,039	82,970,000	2.24
1952	36,310	80,970,000	2.23
1953	35,620	84,060,000	2.36
1954	34,240	85,600,000	2.50

TABLE 9.—Indicated demand for total crude petroleum in 1954

Month	Thousand barrels	Month	Thousand barrels
January	2,803	August	3,353
February	2,958	September	2,568
March	2,783	October	2,961
April	2,964	November	2,486
May	3,196	December	3,075
June	2,760		
July	2,815	Total: 1954	34,722
		1953	35,418

TABLE 10.—Production of crude petroleum, 1950–54, by fields, in thousand barrels

Field	1950	1951	1952	1953	1954
Baxterville	4,951	6,487	6,212	5,940	5,137
Brookhaven	4,714	4,237	3,905	4,211	3,724
Cranfield	4,475	3,334	2,792	2,398	1,776
Eucutta	1,994	1,746	1,670	1,542	1,352
Heidelburg	3,457	3,452	3,437	3,336	3,098
La Grange	4,370	3,666	3,277	2,701	2,269
Mallalieu	3,535	2,520	1,944	1,484	1,252
Tinsley	5,190	5,071	4,934	4,545	4,326
Yellow Creek	1,528	1,650	1,633	1,652	1,526
Other fields	4,022	4,876	6,506	7,811	9,780
Total	38,236	37,039	36,310	35,620	34,240

TABLE 11.—Sales of petroleum products, 1953–54

Product	Thousand barrels		Change from 1953 (percent)
	1953	1954	
Gasoline [1]	12,403	12,955	+4
Kerosine	1,225	1,187	−3
Range oil	533	530	[2]
Distillate fuel oil	1,774	1,619	−9
Residual fuel oil	163	160	−2

[1] Consumption of gasoline from American Petroleum Institute.
[2] Less than 1 percent.

NONMETALS

Clays.—Clay production, from 21 counties in Mississippi, decreased 2 percent in quantity and less than 1 percent in value from 1953. Important quantities of bentonite, fuller's earth, ball clay, fire clay, and miscellaneous clay were produced. There were 15 structural-clay-product manufacturers in the State.

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The average value of ball clay in Mississippi increased from $14.57 to $15.13 per ton, but this rise in price did not offset the production drop. The refractory industry was the largest consumer of the two-county production of Mississippi ball clay.

Bentonite production, reported from 4 counties, decreased slightly in tonnage and value, but the average price increased from $10.72 to $10.77 per ton during 1954. Important uses of bentonite were for decoloration and filtration of oils, bonding clay for refractories, fillers, and drilling muds, respectively.

Production of fuller's earth, for use as an absorbent, increased in quantity, while a price drop from $41.94 to $36.80 per ton during 1954 explained the slight decrease in total value. The entire State production originated in Tippah County.

Production of fire clay decreased in quantity and value during 1954, and the average price dropped from $1.69 to $1.61 per ton. Fire clay was used for heavy clay products.

The production of miscellaneous clay increased sharply both in tonnage and total value. The average price remained unchanged at $1.06 per ton.

Sand and Gravel.—The production and value of sand and gravel in Mississippi increased 105 and 99 percent, respectively, from 1953. This notable gain resulted mainly from the canvassing of 15 new respondents in 1954, which added about 2 million tons valued at $1.3 million. Government-and-contractor sand and gravel, however, declined 60 percent in tonnage and 77 percent in value to 233,378 short tons valued at $107,450 in 1954. Sand was used for molding, engine sand, glass, railroad ballast, building, paving, and miscellaneous uses. Gravel was used for building, paving, railroad ballast, and other gravel purposes. Copiah County reported the largest production of sand and gravel in the State.

TABLE 12.—Sand and gravel sold or used by producers, 1945–49 (average) and 1950–54

Year	Commercial		Government-and-contractor		Total		Average value per ton
	Short tons	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	1,903,365	$1,198,047	570,719	$275,220	2,474,084	$1,473,267	$0.60
1950	2,274,938	1,786,384	489,506	199,524	2,764,444	1,985,908	.72
1951	2,404,583	1,890,584	607,569	388,450	3,012,152	2,279,034	.76
1952	1,845,864	1,482,581	450,713	350,725	2,296,577	1,833,306	.80
1953	2,070,123	1,713,362	583,523	460,509	2,653,646	2,173,871	.82
1954	5,208,459	4,179,421	233,378	107,450	5,441,837	4,286,871	.79

Stone.—Limestone used in manufacturing cement was included in the production data for stone for the first time which accounts for the 377-percent increase in quantity and 315-percent increase in value reported over 1953. However, the production of noncommercial agricultural limestone also increased sharply and approached the 1952 amount. The Mississippi State Lime Plant Board increased its output 140 percent; the value increased 109 percent.

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REVIEW BY COUNTIES

Mineral fuels or nonmetallic minerals output was reported in 39 of the 82 counties in Mississippi. Petroleum was produced in 23 counties, natural gas in 16, natural-gas liquids in 3, and clays and sand and gravel in 21.

Adams.—Adams County in 1954 led in the production of crude oil and natural-gas liquids and was second in the production of sand and gravel. Natchez Gravel Co. and St. Catherine Gravel Co. produced sand and gravel for building and paving purposes near Natchez. Drilling of 42 exploratory wells resulted in the discovery of 1 productive oil well.

Alcorn.—Sand and gravel was mined by Worsham Bros. near Corinth. Corinth Brick & Tile Co. manufactured heavy clay products from clay mined near Corinth. Both tonnage and value rose sharply in 1954.

Carroll.—Government-and-contractor sand and gravel was produced by the Leflore County engineer for paving purposes. Miscellaneous clay for common brick and other clay products was produced at Indianola by the Delta Brick & Tile Co.; this production declined 36 percent in value compared with 1953.

TABLE 13.—Value of mineral production in Mississippi, 1953–54, by counties

County	1953	1954	Minerals produced in 1954, in order of value
Adams	$19,193,181	$20,325,581	Petroleum, natural-gas liquids, sand and gravel, natural gas.
Clarke	424,012	467,535	Petroleum.
Copiah	(1)	759,125	Sand and gravel.
Forrest	704,089	1,227,552	Sand and gravel, natural gas, petroleum, clay.
Franklin	3,493,352	3,369,552	Petroleum, natural gas.
Harrison	(1)	93,069	Sand and gravel.
Hinds	79,136	253,838	Petroleum, clay, natural gas, sand an gravel.
Jasper	8,128,968	8,728,528	Petroleum, natural gas.
Jefferson	2,695,450	4,888,910	Do.
Jefferson Davis	4,331,682	4,124,520	Natural gas, petroleum, natural-gas liquids.
Jones	870,895	1,270,645	Petroleum, natural gas, clay.
Lamar	7,850,298	7,586,293	Petroleum, natural gas.
Lincoln	14,593,101	14,210,824	Petroleum, natural-gas liquids, clay.
Lowndes	366,159	401,392	Sand and gravel, clay.
Madison	786,585	923,704	Petroleum, natural gas.
Marion	9,704,027	8,972,935	Do.
Monroe	1,455,599	1,423,758	Clay, sand and gravel, natural gas, petroleum.
Pearl River	92,447	110,482	Sand and gravel, natural gas, clay.
Simpson	3,930,170	3,794,552	Natural gas, petroleum.
Smith	793,649	1,157,617	Petroleum, clay, natural gas.
Wayne	7,333,040	7,491,770	Petroleum.
Wilkinson	544,981	849,552	Do.
Yazoo	10,864,575	11,627,192	Petroleum, sand and gravel.
Undistributed [2]	9,632,604	6,503,776	
Total	107,868,000	110,563,000	

[1] Included with "Undistributed" to avoid disclosing individual data.
[2] Includes value of mineral production and principal minerals produced in 1954 in the following counties Alcorn (sand and gravel and clay), Amite (petroleum), Attala (clay), Washington (sand and gravel).

Clay.—West Point Gravel Co. quarried structural sand, paving sand, and paving gravel near West Point. Noncommercial agricultural limestone was produced by the Mississippi State Lime Plant Board.

Copiah.—Copiah County was the leading producer of sand and gravel in Mississippi during 1954. Gatesville Sand & Gravel Co. and Green Bros. (both at Jackson) and the Traxler Gravel Co. near

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Utica produced building sand, paving sand, railroad ballast sand, structural gravel, paving gravel, and railroad ballast gravel.

De Soto.—Paving gravel and building sand and gravel were quarried by the Memphis Stone & Gravel Co. and Smiley Sand & Gravel Co. in De Soto County.

Forrest.—Forrest County ranked fourth in the production of sand and gravel in the State for 1954. American Sand & Gravel Co. operated a quarry near Hattiesburg. Natural gas and crude oil were produced in the county. Hattiesburg Brick Works manufactured heavy clay products.

Franklin.—Petroleum and natural gas were reported in Franklin County. Two oil wells were discovered by drilling 12 exploratory wells.

Harrison.—Sand and gravel, Harrison County's only mineral commodity, was produced by Bell Gravel Co., Gulfport Gravel Co., and Legett Sand & Gravel Co. from pits near Gulfport.

Hinds.—Clay was mined for the manufacture of brick, tile sewer pipe, and other heavy clay products by the Johnson Cone Brick Co. and Tri-State Brick & Tile Co., with plants near Jackson. Face brick was manufactured by Jackson Brick Co. near Jackson. Van Downing Sand & Gravel Co. produced sand and gravel. Petroleum and natural-gas production was reported in the county. Three exploratory wells drilled in 1954 all proved oil productive.

Itawamba.—Filtrol Corp. produced and activated bentonite at its plant in Itawamba County for uses in filtration and decoloring.

Jasper.—Jasper County was the fourth largest producer of crude oil in Mississippi. Natural gas was produced from fields in the county.

Jefferson.—The petroleum produced was the county's largest mineral value. Natural gas was also produced in the county. An extensive exploratory drilling campaign during the year resulted in 2 productive oil wells and 30 dry holes.

Jefferson Davis.—Production of natural gas in 1954 in Jefferson Davis County gave it first rank in the State, along with Simpson County. Crude oil was produced and natural-gas liquids were recovered by Southern Natural Gas Co. at Gwinville.

Jones.—Laurel Brick Works produced face brick at its plant near Laurel. Petroleum and natural gas were reported in the county, and oil was discovered in one exploratory well.

Lamar.—Lamar County ranked fourth in the State for the production of natural gas. Crude oil was produced from the Baxterville fields in Lamar and Marion Counties.

Lincoln.—Lincoln County was the second largest producer of crude oil in Mississippi in 1954. Production was reported from Brookhaven and Mallalieu field in the county. Natural-gas liquids, second in production, were recovered at The California Co. cycling plant in the Brookhaven field. Brookhaven Pressed Brick & Manufacturing Co. mined miscellaneous clay for brick at Brookhaven. One exploratory well drilled proved oil productive.

Lowndes.—Sand and gravel, Lowndes County largest mineral output, was produced near Columbus by Columbus Gravel Co., Fleming Gravel Co., Smith Gravel Co., and Williams Sand & Gravel Co. for building, paving, railroad ballast, and other uses. Columbus Brick Co. stripped clays at its mine near Columbus for the manufacture of

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common brick, structural tile, paving tile, drain tile, and sewer tile and other products.

Madison.—Crude oil and natural gas were reported in the county from the Pickens and Flora fields. The drilling of 3 exploratory wells resulted in the discovery of 1 oil well and 1 gas well.

Marion.—Marion County ranked third in the production of natural gas in the State in 1954 and sixth in the production of crude oil.

Monroe.—Bentonite was produced by International Minerals & Chemical Corp. from its Amory mine and by American Colloid Co. from its Aberdeen mine. Sand and gravel for building, paving, and railroad ballast was produced by Amory Sand & Gravel Corp., Francis Sand & Gravel Co., and Nash Contracting Co. Natural gas and crude oil were produced. Exploratory drilling during the year resulted in 1 productive oil well and 3 dry holes.

Panola.—Ball clay was produced from the Crenshaw mine by the Kentucky-Tennessee Clay Co. for use in refractories. A small quantity of ball clay was exported for foreign consumption. Panola County was the largest ball-clay producer in the State during 1954, and fire clay accounted for the total clay production in the county. A small quantity of paving gravel was mined by J. L. O'Neal.

Pearl River.—Paving sand and gravel was mined near Picayune by Bean-Wilkes. Natural gas was produced from fields within the county. A small quantity of bentonite was mined near McNeil by the Pearl River Clay Co. for filler and drilling-mud uses. Although no petroleum was reported in 1954, addition of the sand and gravel industry boosted the total county mineral value 16 percent. One gas well was discovered by exploratory drilling.

Perry.—Molding sand, building sand, paving gravel, and other gravel were produced by Richton Sand & Gravel Co. near Mobile. The sharp rise in this production offset the moderate decline in petroleum production and resulted in a 73-percent increase in the total mineral value. One oil well was discovered by exploratory drilling.

Pontotoc.—A small quantity of miscellaneous clay for heavy clay products was produced near Pontotoc by Pontotoc Brick Co.

Prentiss.—Common brick, structural tile, and other heavy clay products were manufactured by Baldwyn Brick & Tile Co. from miscellaneous clay mined in adjoining Lee County.

Rankin.—Marquette Cement Co. increased production and shipments at its Brandon mill to meet the increased demand of the building- and road-construction industries. Glass sand was quarried by the Worley Bros. Sand & Gravel near Jackson. Natural gas was reported from the Jackson field.

Simpson.—Simpson County shared with Jefferson Davis County first rank as a producer of natural gas in Mississippi during 1954. Petroleum was produced from the Gwinville field.

Smith.—Petroleum was the mineral of largest value produced in Smith County. Bentonite used for decoloring oil and filtration was produced at the Chisholm mine by Filtrol Co. Natural gas was produced in the county. One exploratory well proved oil productive.

Sunflower.—Delta Brick & Tile Co. stripped alluvial clay near Indianola for the manufacture of common brick, building tile, and other heavy clay products.

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Tippah.—Fuller's earth, montmorillonite, for absorbent uses was produced by the Wyandotte Chemical Corp. from its Blue Mountain mine.

Warren.—The world's first ammonia plant to employ partial oxidation of natural gas went on 24-hour production at Vicksburg. The plant was built at an estimated cost of $14 million by Spencer Chemical Co.[7]

Washington.—Washington County was the State's third larger producer of sand and gravel in 1954. Paving sand and gravel was produced by the Greenville Dredging Co. and building sand, paving sand, structural gravel, and paving gravel were produced by the Greenville Gravel Co. near Greenville. The district engineer contracted for sand for paving purposes in the county.

Wayne.—Wayne County was the fifth largest producer of crude oil in the State. Ten exploratory wells were drilled, but all were dry holes.

Wilkinson.—Petroleum was produced from existing fields in the county. The drilling of 12 exploratory wells resulted in the discovery of 3 oil wells.

Yazoo.—Yazoo County was the third largest producer of crude oil in Mississippi in 1954. Production was from the Tinsley field in the county. Anderson Sand & Gravel Co. mined paving gravel from its Yazoo mine near Yazoo City. Mississippi Chemical Corp. completed expansion of its ammonia plant at Yazoo City, increasing daily production from 120 tons to 290 tons.[8]

[7] Oil and Gas Journal, Vol. 52, No. 40, Feb. 8, 1954.
[8] Oil and Gas Journal, Vol. 53, No. 24, Oct. 18, 1954.

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The Mineral Industry of Missouri

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Division of Geological Survey and Water Resources, Department of Business Administration of Missouri.

By W. G. Diamond [1] and G. A. Muilenburg [2]

MINERAL production in Missouri in 1954 totaled $130 million, compared with $128 million in 1953. Missouri ranked first in the Nation in the production of lead, second in the production of barite, and third in the production of fire clay. Sixteen minerals and mineral fuels were produced in the State—6 metals, 6 nonmetals, and 4 mineral fuels. The five principal minerals, in order of value, were lead, cement, stone, lime, and sand and gravel. Of the 114 counties in Missouri, 112 reported mineral production in 1954. Nonmetals composed 63 percent of the total mineral value, metals 30 percent, and mineral fuels 7 percent. Metal mining centered in the southeastern lead belt of St. Francois and Madison Counties, in the southwestern zinc-lead area of Jasper and Newton Counties, and in

TABLE 1.—Mineral production in Missouri, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Barite	330,763	$3,338,395	312,791	$3,047,436
Cement, 376-pound barrels	9,860,179	26,238,460	11,379,257	31,425,190
Clays	2,231,596	11,182,096	1,927,285	5,858,756
Coal	2,393,304	9,848,903	2,513,593	10,028,293
Copper (recoverable content of ores, etc.)	2,374	1,362,676	1,925	1,135,750
Iron ore (usable), long tons, gross weight	274,693	[3]	173,394	[3]
Lead (recoverable content of ores, etc.)	125,895	32,984,490	125,250	34,318,500
Lime (open-market)	1,212,107	12,084,130	1,125,919	11,165,381
Natural gas, million cubic feet	15	3,000	16	[3]
Petroleum (crude), thousand 42-gallon barrels	39	[3]	96	[3]
Sand and gravel	5,792,058	5,233,999	9,891,305	10,203,481
Silver (recoverable content of ores, etc.), troy ounces	359,781	325,620	352,971	319,457
Stone	[2] 13,947,834	[2] 20,552,840	18,615,739	24,695,110
Zinc (recoverable content of ores, etc.)	9,981	2,295,630	5,210	1,125,360
Undistributed: Native asphalt, manganese ore, ground sand and sandstone (1953), stone (dimension marble) (1953), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2)		2,756,746		2,908,454
Total Missouri		128,207,000		[4] 131,280,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Value included with "Undistributed."
[3] Excludes certain stone, value for which is included with "Undistributed."
[4] The total has been adjusted to eliminate duplication in the value of clays and stone.

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south central counties. Nonmetal mining was widely distributed, mainly south of the Missouri River. The five most productive counties, in order of value, were: St. Francois, St. Louis, Ste. Genevieve, Jackson, and Cape Girardeau.

Some of the production data for 1954 were collected jointly with the Bureau of the Census, United States Department of Commerce. Production totals will be compared with the Bureau of the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

Defense Minerals Exploration Administration Projects.—Government assistance in financing exploration projects in search of reserves of strategic minerals, authorized by the Defense Production Act of 1950, continued throughout 1954. The projects listed in table 2 were active under the program during the year.

TABLE 2.—Defense Minerals Exploration Administration contracts active during 1954

Contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
National Lead Co.	Mill Creek, John Newcum, U. S., Castor Creek, Liberty, Higdon, and Turkey Creek areas.	Lead, copper, cobalt, nickel.	June 8, 1951	$391,540	64
Dale Mining Co.	Patterson and Clark tracts.	Zinc, lead	June 22, 1952	[1] 31,104	31
Lucy A. McLaren	Leases in St. Francois County.	Lead, zinc	Dec. 23, 1954	7,050	None

[1] Increased by contract amendment.

EMPLOYMENT IN THE MINERAL INDUSTRIES

Employment.—Average annual employment in the Missouri mining industries in 1954 decreased 4 percent from 1953. Average employment in the nonmetals industries increased, while in the metal- and coal-mining industries it decreased, according to the Division of Employment Security, Department of Labor and Industrial Relations of Missouri.

Accidents.—One fatal accident occurred in the coal industry of Missouri in 1954 and 1 fatality in the nonmetallic industry. No fatal accidents were reported in the metallic and oil and gas industries.

Wages.—Average 1954 hourly and weekly earnings in the mineral industries increased slightly over 1953 averages, according to the Division of Employment Security, Department of Labor and Industrial Relations of Missouri. The upward trend in wages has been continuous during the past several years.

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TABLE 3.—Average annual employment and earnings of mining industries, 1953–54 [1]

Industry	1953				1954			
	Average employment	Average weekly earnings	Average weekly hours	Average hourly earnings	Average employment	Average weekly earnings	Average weekly hours	Average hourly earnings
Metal mining	3,800	$74.28	40.1	$1.85	3,527	$76.09	40.0	$1.90
Nonmetal mining	3,863	63.97	43.8	1.46	3,909	67.78	42.9	1.58
Coal mining	1,098	72.81	36.2	2.01	962	75.34	37.6	2.01
Total	8,761				8,398			

[1] Letter to Bureau of Mines, Henry J. St. Clair, Division of Employment Security, Department of Labor and Industrial Relations, State of Missouri.

REVIEW BY MINERAL COMMODITIES

METALS

Missouri continued as the Nation's major producer of lead for the 47th consecutive year. The production of metals, except manganese, continued to decrease during 1954.

Cadmium, Germanium, Gallium, and Indium.—Minerals of these minor metals occur as trace elements in the lead-zinc ores of Missouri and were recovered as byproducts in the smelting operations. The State origin of these minor metals is indeterminate, since the source is an accumulation of both domestic and foreign concentrates and ores and no assays are made for these commodities. The lead and zinc ores of Missouri contain small quantities of germanium, some of which was recovered from flue dusts of zinc smelters in other States that received Missouri concentrates.

Copper.—Madison and St. Francois Counties reported copper output from the lead-copper ores of southeastern Missouri. Copper production totaled 1,900 tons valued at $1.1 million, down 19 percent in quantity and 17 percent in value from 1953. Copper prices held steady throughout 1954, opening and closing around 29.7 cents per pound.

Iron Ore.—Iron ore was mined in five counties in Missouri in 1954, with St. Francois County, the site of Ozark Ore Co. Iron Mountain operations, the leading producer, followed by Oregon, Ozark, Shannon, and Howell Counties. Production in 1954 dropped 37 percent from 1953. A 25-acre site near Leeper, Mo., was cleared of timber for construction of an iron-ore treatment plant. The new plant is to be operated by Visueva Mining Corp. of Poplar Bluff, Mo.

Lead.—The 1954 mine production of recoverable lead approximated the 1953 output but increased 4 percent in value. Missouri was the leading lead producing State in the Nation, St. Joseph Lead Co. was the Nation's leading producing company, and its Federal mine in St. Francois County had the largest output in 1954. Mine production of Missouri lead, lead-copper, and lead-zinc ore totaled over 8 million

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tons, including 1.5 million tons of tailings, which yielded 182,000 tons of lead concentrate containing 125,250 tons of recoverable metal valued at $34.3 million. The southeastern Missouri region produced a major portion of the State's recoverable lead. The leading producing companies were St. Joseph Lead Co., Mine La Motte Corp., National Lead Co., and American Zinc, Lead & Smelting Co.

National Lead Co. was active geologically in the vicinity of company mines near Fredericktown in the southeastern Missouri lead belt. This work, with geophysical work previously completed, was used to guide development drifting. The American Metal Co., Ltd., terminated its exploration program in this area. The work had included surface drilling. The American Zinc, Lead & Smelting Co. closed down the Quick Seven mine in Jasper County and confined all geological activities to the Nellie B operation in the Picher field.

Lead metal price opened 1954 at 13.5 cents per pound, New York, declined to a low of 12.5 cents in March, then gradually rose to 15 cents in October, at which price it closed the year. The Government purchase program of lead and zinc for stockpiling under General Services Administration (GSA) begun in June was largely responsible for the recovery and stabilization of lead metal price the latter part of the year.

Manganese Ore.—Evans & Parker continued exploration and development of manganese deposits near Eminence in Shannon County. Manganese-ore production increased over 1953.

Silver.—The Herculaneum, Mo., lead smelter and refinery of the St. Joseph Lead Co. refined pig lead to recover 353,000 fine ounces of silver in 1954. Silver recovery was incidental to the refining of base bullion produced from lead and lead-copper ore of southeastern Missouri.

TABLE 4.—Mine production of silver, copper, lead, and zinc in 1954, by months, in terms of recoverable metals

Month	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Month	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	37,034	161	9,972	586	September	26,561	161	9,882	286
February	29,848	200	10,711	577	October	26,167	154	10,089	322
March	32,049	162	11,827	646	November	34,729	153	10,623	393
April	29,068	168	10,779	564	December	28,297	154	11,187	241
May	26,427	154	9,784	412					
June	27,215	158	10,225	441	Total:				
July	27,462	141	9,956	345	1954	352,971	1,925	125,250	5,210
August	28,114	159	10,215	397	1953	359,781	2,374	125,895	9,981

Titanium.—National Lead Co. began constructing new facilities for producing titanium dioxide at St. Louis, thereby increasing the plant's capacity about 36,000 tons a year.

Zinc.—Mine production of recoverable zinc in 1954 declined 48 percent to 5,210 tons when the Quick Seven operation of American Zinc, Lead & Smelting Co. abandoned operations in June because of

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depleted ore reserves. Southeastern Missouri produced 61 percent of the output and Southwestern Missouri 39 percent. St. Francois County reported the largest production. St. Joseph Lead Co. was the leading producer, followed by American Zinc, Lead & Smelting Co. and Dale Mining Co. Zinc-metal prices continued the decline that began in 1953 into the early months of 1954, opening at 10 cents, East St. Louis, dropping to a low of 9.25 cents in February, then gradually rising to 11.5 cents in September, at which price it held for the remainder of the year. The Government purchase program for lead and zinc, which started in June, had a stabilizing effect on base-metal prices.

TABLE 5.—Mine production of silver, copper, lead, and zinc, 1945–49 (average), 1950–54, and total 1860–1954, in terms of recoverable metals

Year	Mines producing	Material sold or treated		Silver		Copper	
		Crude ore (short tons)	Old tailings (short tons)	Fine ounces	Value	Short tons	Value
1945–49 (average)	----	6,520,551	792,217	99,085	$84,651	2,611	$946,632
1950	68	6,384,138	1,036,002	236,273	213,839	2,982	1,240,512
1951	54	6,499,122	1,574,379	184,424	166,913	2,422	1,172,248
1952	67	7,128,550	1,750,818	517,432	468,302	2,576	1,246,784
1953	28	6,674,300	1,483,157	359,781	325,620	2,374	1,362,676
1954	16	6,598,647	1,579,068	352,971	319,457	1,925	1,135,750
1860–1954	----	(1)	(1)	6,144,078	4,700,180	39,752	14,877,812

Year	Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	
1945–49 (average)	135,549	$35,140,044	14,771	$3,568,468	$39,739,795
1950	134,626	36,349,020	8,189	2,325,676	40,129,047
1951	123,702	42,800,892	11,476	4,177,264	48,317,317
1952	129,245	41,616,890	13,986	4,643,352	47,975,328
1953	125,895	32,984,490	9,981	2,295,630	36,968,416
1954	125,250	34,318,500	5,210	1,125,360	36,899,067
1860–1954	9,200,433	1,240,656,870	3,695,647	489,594,069	1,749,828,931

[1] Data not available.

TABLE 6.—Mine production of silver, copper, lead, and zinc in 1954, by classes of ore or other sources of material, in terms of recoverable metals

Source	Number of mines	Material sold or treated (short tons)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lead ore [1]	8	7,958,007	352,971	1,925	125,173	3,169
Zinc ore	8	219,708	----	----	77	2,041
Total	16	8,177,715	352,971	1,925	125,250	5,210

[1] Includes lead-copper ore from one mine; also 1,579,068 tons of old tailing remilled, concentrate from which were mixed with those from crude ore.

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TABLE 7.—Mine production of lead and zinc in Southeastern and Central Missouri, 1945–49 (average), and 1950–54, in terms of concentrates and recoverable metals [1]

Year	Lead concentrate (galena)		Zinc concentrate [2] (sphalerite)		Recoverable metal content [3]			
					Lead		Zinc	
	Short tons	Value [4]	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	188,676	$27,674,350	1,053	$51,485	133,097	$34,531,413	[5] 622	$155,178
1950	191,439	28,522,322	2,742	260,600	133,680	36,093,600	[5] 1,546	439,064
1951	176,764	32,484,309	4,475	509,658	122,318	42,322,028	[6] 2,277	828,828
1952	178,746	33,325,589	5,703	637,709	122,942	39,587,324	[6] 3,872	1,285,504
1953	182,418	26,622,152	5,369	347,482	125,273	32,821,526	[6] 3,180	731,400
1954	181,790	29,680,857	6,069	480,412	125,173	34,297,402	[6] 3,169	684,504

[1] Based on Southeastern and Central Missouri ore (dirt) and old tailings treated at mills during calendar year indicated.
[2] Includes zinc-lead carbonate concentrates.
[3] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of concentrate (ore) and metal it should be borne in mind that the value given for the concentrate is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.
[4] Values given are to a certain extent arbitrary, as part of the lead concentrate is smelted by the producer.
[5] Includes zinc recovered from lead-smelter slag.
[6] Includes zinc recovered from byproduct matte from lead smelting as follows: 1951, 138 tons; 1952, 900 tons; 1953, 327 tons; 1954, 427 tons.

TABLE 8.—Mine production of lead and zinc in Southwestern Missouri, 1945–49 (average) and 1950–54, in terms of concentrates and recoverable metals [1]

Year	Lead concentrate				Zinc concentrate			
	Galena		Carbonate		Sphalerite		Silicate	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	3,178	$567,812	79	$11,803	26,543	$2,936,302	356	$23,613
1950	1,199	189,224	34	3,623	12,122	1,090,592	100	6,537
1951	1,767	423,857	-------	-------	17,370	2,074,867	-------	-------
1952	8,113	1,701,121	-------	-------	18,671	2,138,108	-------	-------
1953	791	135,603	-------	-------	12,257	849,141	-------	-------
1954	103	16,826	-------	-------	3,713	378,782	-------	-------

Year	Recoverable metal content [2]			
	Lead		Zinc	
	Short tons	Value	Short tons	Value
1945–49 (average)	2,452	$608,631	14,149	$3,413,290
1950	944	254,880	6,591	1,871,844
1951	1,384	478,864	9,199	3,348,436
1952	6,303	2,029,566	10,114	3,357,848
1953	622	162,964	6,801	1,564,230
1954	77	21,098	2,041	440,856

[1] Based on Southwestern Missouri ore (dirt) and old tailings treated at mills during the calendar year indicated.
[2] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of concentrate (ore) and metal, it should be borne in mind that the value given for the concentrate is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

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TABLE 9.—Tenor of lead and zinc ore, old tailings and slimes milled, and concentrates produced in 1953–54, by districts

	Southeastern Missouri		Southwestern Missouri	
	1953	1954	1953	1954
	Crude ore [1]	Crude ore [1]	Crude ore	Crude ore
Total ore, etc., milled.....short tons..	7,674,491	7,958,007	482,996	219,708
Total concentrate produced:				
Lead.....do....	182,418	181,790	791	103
Zinc.....do....	5,369	6,069	12,257	3,713
Ratio of concentrate to ore, etc.:				
Lead.....percent..	2.38	2.28	0.16	0.05
Zinc.....do....	0.07	0.08	2.54	1.69
Metal content of ore, etc.:[2]				
Lead.....do....	1.62	1.57	0.13	0.04
Zinc.....do....	0.04	0.04	1.41	0.93
Average lead content of galena concentrate.....do....	70.12	70.26	80.03	76.70
Average zinc content of sphalerite concentrate...do....	59.04	58.10	61.66	61.08
Average value per ton:				
Galena concentrate	$145.94	$163.27	$171.43	$163.36
Sphalerite concentrate	64.72	79.16	69.28	102.02

[1] Includes lead-copper ore and old tailings remilled: 1953, 1,483,157 tons; 1954, 1,579,068 tons.
[2] Figures represent metal content of crude ore only insofar as it is recovered in the concentrates; data on tailing losses not available.

Mine Mills and Smelters.—The Herculaneum, Mo., lead smelter and refinery of the St. Joseph Lead Co. operated at near capacity throughout 1954. Nine mine mills were operating in Missouri in January 1954—7 in southeastern Missouri and 2 in southwestern Missouri. St. Joseph Lead Co. operated 4 mills in St. Francois County—Federal, Bonne Terre, Desloge, and Leadwood—and the Indian Creek mill in Washington County. Mine La Motte Corp. operated its Mine La Motte mill in Madison County. National Lead Co. operated its Madison mill in Madison County. American Zinc, Lead & Smelting Co. operated its Quick Seven mill in Jasper County through May and then shut down for the rest of the year. Dale Mining Co. operated its Dale mill in Newton County.

TRI-STATE DISTRICT

The Tri-State district of southwestern Missouri, Kansas, and Oklahoma reported mine output of 4.1 million tons of crude ore and 18,000 tons of old tailings yielding 24,500 tons of lead concentrate containing 18,300 tons of recoverable lead and 127,000 tons of zinc concentrate containing 64,300 tons of recoverable zinc. Crude-ore tonnage increased 18 percent, lead concentrate 41 percent, and zinc concentrate 24 percent over 1953. Southwestern Missouri production totaled 3 percent of the district zinc concentrate and less than 1 percent of its lead concentrate. Oklahoma was responsible for 78 percent of the district lead concentrate and 66 percent of its zinc concentrate, while Kansas totaled 22 percent of the lead concentrate and 31 percent of the zinc concentrate.

There were 127 mines operating in 1954, of which 5 were in southwestern Missouri, 96 in Oklahoma, and 26 in Kansas, 67 less than in 1953. There were 9 mine mills operating in January, with 7 con-

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tinuing into December. A tailing mill reported small production early in the year. One mine mill started operations later in the year, but 3 shut down. The Eagle-Picher Co. (Oklahoma-Kansas) was the district's largest lead-zinc producer, followed by American Zinc, Lead & Smelting Co. (Oklahoma-southwestern Missouri), National Lead Co. (Kansas), Buffalo Mining Co. (Oklahoma), and John Henderson (Oklahoma-Kansas).

TABLE 10.—Mine production of lead and zinc concentrate in the Tri-State district (Kansas, Oklahoma, and Southwestern Missouri), 1945–49 (average) and 1950–54

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	34,367	$6,245,059	205,712	$21,126,704	25,788	$7,103,037	110,223	$26,897,001
1950	40,714	6,245,660	150,019	13,934,927	31,157	8,412,390	80,558	22,878,472
1951	36,300	7,720,550	170,263	21,023,818	26,906	9,309,476	91,553	33,325,292
1952	36,333	7,388,754	167,474	19,537,949	27,356	8,808,632	90,512	30,049,984
1953	17,403	2,715,987	102,821	7,455,540	13,273	3,477,526	55,729	12,817,670
1954:								
Kansas	5,390	916,161	[1] 38,896	2,638,102	4,033	1,105,042	[2] 19,110	4,127,760
SW. Missouri	103	16,826	3,713	378,782	77	21,098	2,041	440,856
Oklahoma	19,004	3,194,245	84,444	5,466,727	14,204	3,891,896	43,171	9,324,936
Total 1954	24,497	4,127,232	[1] 127,053	8,483,611	18,314	5,018,036	[2] 64,322	13,893,552

[1] Includes 360 tons from old tailing remilled.
[2] Includes 194 tons from old tailing remilled.

TABLE 11.—Quoted prices of 60-percent zinc concentrate and 80-percent lead concentrate at Joplin, Mo., in 1954

[E&MJ Metal and Mineral Markets]

Zinc concentrate		Lead concentrate	
Period	Price per short ton	Period	Price per short ton
Jan. 1–Jan. 11	$56.00	Jan. 1–Jan. 11	$166.25
Jan. 25–Jan. 31	52.00	Jan. 19–Jan. 24	159.05
Feb. 23–Mar. 1	50.00	Feb. 23–Mar. 1	151.85
Mar. 12–Mar. 22	54.00	Mar. 12–Mar. 22	159.05
Apr. 2–Apr. 12	58.00	Mar. 30–Apr. 1	166.25
May 28–June 7	60.00	Apr. 2–Apr. 12	169.85
June 8–June 14	64.00	Apr. 13–Apr. 19	173.45
Sept. 7–Dec. 31	68.00	Aug. 31–Sept. 6	177.05
		Sept. 14–Sept. 20	180.65
		Sept. 21–Sept. 27	184.25
		Oct. 5–Dec. 31	187.85

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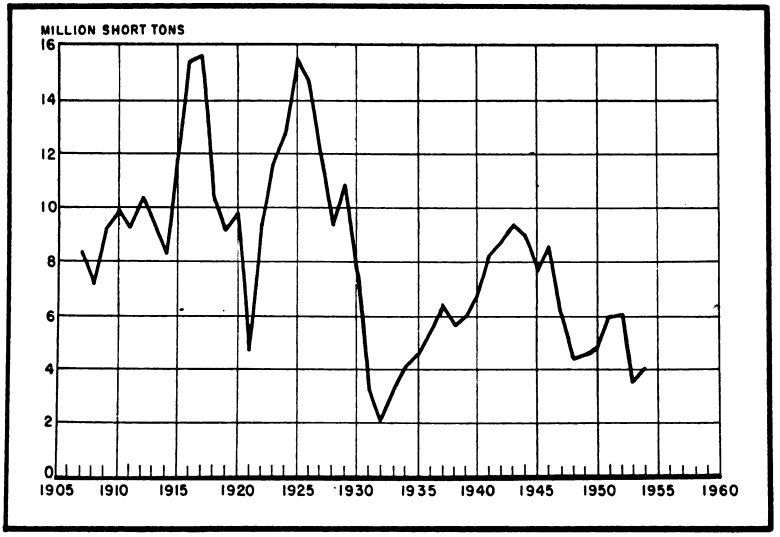

FIGURE 1.—Quantity of crude ore (rock) milled in the Tri-State district, 1907–54.

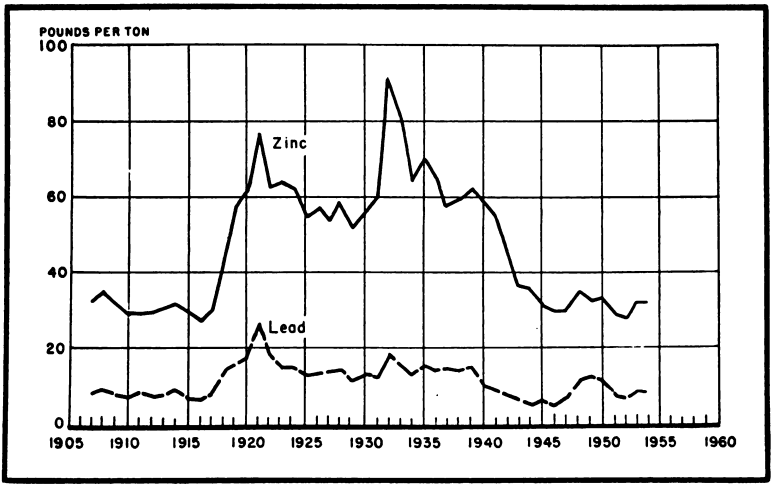

FIGURE 2.—Metal recovered per ton of crude ore (rock) milled in the Tri-State district, 1907–54.

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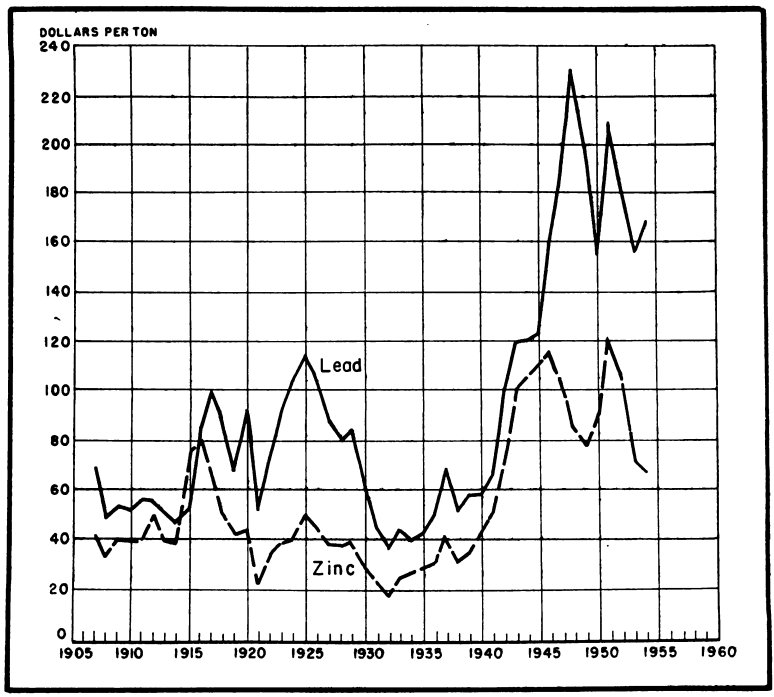

FIGURE 3.—Average prices received by sellers per ton of concentrate in the Tri-State district, 1907–54.

TABLE 12.—Tenor of ore and concentrates in Tri-State district, 1950–54

	1950	1951	1952	1953	1954
Total material milled:					
Crude ore, short tons	4,700,698	5,990,100	6,140,155	3,454,980	4,092,278
Tailings and slimes, do	967,926	746,673	604,350	----------	18,000
Ratio of concentrate to material milled:					
Lead, percent	0.72	0.54	0.54	0.50	0.60
Zinc, do	2.65	2.53	2.48	2.98	3.09
Metal content of material milled:					
Lead, do	0.55	0.40	0.41	0.38	0.45
Zinc, do	1.42	1.36	1.34	1.61	1.56
Average lead content of galena concentrate, percent	78.08	75.62	76.79	77.81	76.28
Average zinc content of sphalerite concentrate, percent	59.66	59.74	60.04	60.22	56.24
Average value per ton:					
Galena concentrate	$153.40	$212.69	$203.36	$156.06	$168.48
Sphalerite concentrate	92.89	123.48	116.66	72.51	66.77

NONMETALS

Barite.—Missouri ranked second in the production of crude barite, with shipments totaling 312,800 tons valued at $3 million. Production was reported from Washington, Morgan, and Miller Counties, with well over 98 percent produced in Washington County. There were washing and grinding plants in Washington and St. Louis Counties.

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TABLE 13.—Barite sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1945–49 (average)	250, 580	$2, 065, 412	$8. 24	1952	304, 080	$2, 919, 795	$9. 60
1950	212, 736	1, 924, 520	9. 05	1953	330, 763	3, 338, 395	10. 09
1951	281, 895	2, 697, 200	9. 57	1954	312, 791	3, 047, 436	9. 74

Cement.—Production of portland cement in Missouri in 1954 totaled 11 million barrels, an increase of 920,500 barrels over 1953 production. Shipments totaled 11.4 million barrels valued at $31.4 million, an increase of 15 percent in volume and 20 percent in value over 1953. Portland cement was produced by five plants operating in St. Louis, Cape Girardeau, Ralls, and Jackson Counties.

The Missouri Portland Cement Co. began production at its new Sugar Creek plant, built beside an older 1-million-barrel-capacity plant that had been abandoned. The rated annual capacity of the new plant was 1.2 million barrels. This company was also reported to have ordered a third kiln for its Prospect Hill plant, which will add 1,350,000 barrels per year to the capacity of this plant or a total of 4.8 million barrels annually. Cement storage will be expanded with construction of 10 silos of 160,000 barrels total capacity.

TABLE 14.—Production and shipments of portland cement, 1945–49 (average) and 1950–54, in 376-pound barrels

Year	Production (barrels)	Shipments		
		Barrels	Value	
			Total	Average per barrel
1945–49 (average)	7, 001, 274	7, 109, 413	$14, 120, 386	$1. 99
1950	9, 777, 855	9, 779, 657	22, 751, 226	2. 33
1951	10, 230, 449	10, 217, 421	25, 760. 473	2. 52
1952	10, 007, 609	10, 086, 850	25, 523, 038	2. 53
1953	10, 281, 230	9, 860, 179	26, 238, 460	2. 66
1954	11, 201, 697	11, 379, 257	31, 425, 190	2. 75

Clays.—Missouri continued as an important source of high-grade refractory clay as well as miscellaneous clay (common clay and shale), in 1954. The total clay sold and used was 1.9 million tons valued at $5.8 million. Production was reported from 22 counties by 87 producers. Fire clay was produced in 14 of the 22 counties and miscellaneous clay in 12 counties. The five principal clay-producing counties were Gasconade, Callaway, Platte, Audrain, and St. Louis. The clays were used principally in manufacturing building, face, and refractory brick; structural, hollow, and drain tile; sewer pipe; lightweight aggregate; pottery wares; and cement.

Lime.—Lime production in Missouri in 1954 decreased 7 percent in quantity and 8 percent in value from 1953, with a total production

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of 1.1 million tons valued at $11.2 million. A major part of the lime output was used for chemical and industrial purposes, other uses being for building, refractory, and agricultural purposes. Over 80 percent of the output was quicklime, the remainder sold being hydrated lime. There were 6 lime plants active in 1954, 2 in Greene County and 1 each in Marion, Newton, St. Francois, and Ste. Genevieve Counties.

Perlite.—Perlite was expanded at a plant in St. Louis from crude rock imported from Western States and used mainly as a lightweight aggregate. Crude perlite is not known to occur in Missouri.

TABLE 15.—Clays sold or used by producers, 1945–49 (average) and 1950–54, by kinds

Year	Fire clay		Diaspore		Burley	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	1,155,803	$2,923,273	38,637	$363,884	39,019	$180,582
1950	1,126,855	3,208,584	40,750	488,464	53,571	334,299
1951	1,453,721	8,249,535	45,020	704,151	73,781	745,032
1952	1,734,612	9,089,960	44,757	705,269	71,433	664,358
1953	1,392,022	8,562,318	50,144	962,384	53,971	563,043
1954	1,170,305	4,460,438	3,322	16,610	9,265	50,835

Year	Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value
1945–49 (average)	515,460	$360,904	1,748,920	$3,828,643
1950	725,551	624,921	1,946,727	4,656,268
1951	782,335	859,720	2,354,857	10,558,438
1952	1,140,217	1,638,833	2,991,019	12,098,420
1953	735,459	1,094,351	2,231,596	11,182,096
1954	744,393	1,330,873	1,927,285	5,858,756

TABLE 16.—Lime (quick and hydrated) sold by producers, 1945–49 (average) and 1950–54[1]

Year	Quicklime (short tons)	Hydrated lime (short tons)	Total lime	
			Short tons	Value
1945–49 (average)	669,493	196,771	866,264	$7,000,588
1950	853,728	181,448	1,035,176	9,447,669
1951	930,132	192,167	1,122,299	11,285,877
1952	949,572	181,398	1,130,970	11,326,941
1953	1,006,393	205,714	1,212,107	12,084,130
1954	917,684	208,235	1,125,919	11,165,381

[1] Includes lime used by producers.

Sand and Gravel.—Sand and gravel output of Missouri in 1954 was reported from 81 counties, with St. Louis, Jefferson, Franklin, Jasper, and St. Charles Counties the 5 leading producers. Major uses were for building and highway construction. Quality silica sand, used in the glass and other ceramic industries, was produced in Jefferson and St. Louis Counties. Much of it was produced by underground mining methods. Total sand and gravel production for the year was 9 million tons valued at $10 million.

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Stone.—1954 production of stone in Missouri totaled 18.7 million tons valued at $24.7 million. Limestone, marble, granite, sandstone, and miscellaneous stone production was reported. For the first time, limestone used in manufacturing cement and lime was included in the stone total. Limestone furnished 93 percent of the value of stone produced, with production reported in 80 counties. Dimension marble was produced in Jasper, Greene, and Ste. Genevieve Counties and crushed marble in Jefferson County. Crushed and dimension granite was produced in Iron County. Dimension sandstone was produced in Wayne County. Miscellaneous stone (chats) was produced in Jasper, Cole, and St. Francois Counties. Commercial producers supplied 97 percent of the output and noncommercial producers the remainder. The principal uses for crushed stone were for concrete, road metal, riprap, and railroad ballast. Dimension stone was used for monumental and building stone.

TABLE 17.—Sand and gravel sold or used by producers, 1945–49 (average) and 1950–54

Year	Commercial operations		Government-and-contractor operations		Total		
	Short tons	Value	Short tons	Value	Short tons	Value	Average value per ton
1945–49 (average)	4,229,000	$3,700,286	[1] 431,891	[1] $217,512	4,660,891	$3,917,798	$0.84
1950	5,316,073	4,812,518	916,338	455,421	6,232,411	5,267,939	.85
1951	6,027,503	5,419,034	782,354	550,815	6,809,857	5,969,849	.87
1952	5,695,296	5,417,628	1,095,126	704,567	6,790,422	6,122,195	.90
1953	4,932,617	4,770,451	859,441	463,548	5,792,058	5,233,999	.90
1954	8,822,467	9,555,223	1,068,838	648,258	9,891,305	10,203,481	1.03

[1] Average of 1945–46, 1948, 1949.

TABLE 18.—Stone sold or used by producers, 1950–54, by kinds

Year	Granite		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value
1950	4,490	$161,935	13,170	$743,135	8,923,470	$12,981,437
1951	7,834	168,607	(2)	(2)	8,856,795	13,532,757
1952	11,618	149,196	(2)	(2)	12,709,705	18,877,717
1953	5,882	164,792	(2)	(2)	12,727,029	18,924,418
1954	3,827	169,935	22,893	1,067,742	17,770,749	22,913,657

Year	Sandstone		Miscellaneous stone [1]		Total stone	
	Short tons	Value	Short tons	Value	Short tons	Value
1950	1,060	$20,315	1,358,210	$499,805	10,300,400	$14,406,627
1951	(2)	(2)	2,418,207	909,222	11,294,227	15,255,427
1952	(2)	(2)	2,372,812	889,254	15,106,544	20,676,958
1953	10,972	23,413	1,191,819	731,423	13,942,531	19,908,540
1954	633	10,957	874,137	589,319	18,615,739	24,695,110

[1] Chats; also includes small quantity of stone.
[2] Figure withheld to avoid disclosing individual company operations.

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Exfoliated Vermiculite.—Exfoliated vermiculite was produced in St. Louis and Jackson Counties from crude vermiculite imported from Western States.

MINERAL FUELS

Asphalt (Native).—The Barton County Rock Asphalt Co. reported production from its pit in Vernon County in 1954, but it was less than in 1953.

Coal.—The 1954 production of bituminous coal in Missouri increased 5 percent and totaled 2.5 million tons valued at $10 million. Production was reported from 20 counties by 78 producers, with Henry, Randolph, Bates, St. Clair, and Barton Counties the 5 principal ones. Coal was produced mainly by open-pit methods.

TABLE 19.—Coal production, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	3,924,382	$13,091,233	1952	2,954,450	$12,048,141
1950	2,963,081	12,369,000	1953	2,393,304	9,848,903
1951	3,269,283	13,405,436	1954	2,513,593	10,028,293

Natural Gas.—Quantities of natural gas were reported from several northwestern counties of Missouri in 1954. Production approximated that in 1953.

Petroleum.—Small quantities of crude petroleum were reported in the St. Louis area and near Tarkio in Atchison County in 1954. Output and value more than doubled that for 1953.

REVIEW BY COUNTIES

Mineral production was reported in 112 of the 114 counties in Missouri in 1954. The five leading producing counties, in order of value, were St. Francois, St. Louis, Ste. Genevieve, Jackson, and Cape Girardeau. No mineral production was reported in Chariton and Schuyler Counties.

Adair.—Coal was mined by Billy Creek Coal Co., Blacksmith Coal Co., Inc., Corrigan Coal Co., Inc., and Fireside Coal Co., Inc. Bailey Limestone Quarry produced crushed limestone for concrete, road metal, and agricultural purposes.

Andrew.—Limestone was quarried and crushed by the United States Army Corps of Engineers for use in riprapping the banks of the Missouri River to maintain the proper channel.

Atchison.—Paving sand was produced under contract to the Missouri State Highway Department from deposits in Atchison County. Petroleum was recovered near Tarkio.

Audrain.—Audrain County ranked fourth in the State in the production of clays. Plastic and flint fire clay and fire-clay products were produced in the Mexico, Farber, and Vandalia area. Producers included A. P. Green Fire Brick Co., Mexico Refractories Co., Laclede-Christy Co., and Forest Johnson. Limestone for concrete, road metal, and agricultural purposes was produced by Molino Lime Co. and Sulgrove Mining & Quarry Co. The Missouri State Highway Department and Molino Lime Co. produced paving sand and gravel.

Barry.—Crushed limestone was produced by G. F. Warner and Troy Douthitt Lime Co.

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TABLE 20.—Value of mineral production in Missouri, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value
Adair	$295,712	$441,962	Coal, stone.
Andrew	(2)	(2)	Stone.
Atchison		(2)	Sand and gravel, petroleum.
Audrain	2,640,343	633,893	Clays, stone, sand and gravel.
Barry	45,082	21,652	Stone.
Barton	94,910	(2)	Coal.
Bates	3,029,608	(2)	Coal, stone, sand and gravel.
Benton	35,000	(2)	Sand and gravel.
Bollinger		6,750	Do.
Boone	561,443	486,314	Stone, coal, sand and gravel, clays.
Buchanan	338,555	263,924	Sand and gravel, stone, clays.
Butler	38,954	100,169	Stone, sand and gravel.
Caldwell	(2)	120,722	Stone.
Callaway	2,625,607	1,645,606	Clays, coal, stone, sand and gravel.
Camden		6,000	Sand and gravel.
Cape Girardeau	4,731,292	5,703,231	Cement, stone, sand and gravel, clays.
Carroll	(2)	(2)	Stone.
Carter		12,675	Sand and gravel.
Cass	340,363	351,896	Stone, clays.
Cedar	(2)	(2)	Sand and gravel, stone.
Christian	(2)	(2)	Do.
Clark	(2)	(2)	Stone.
Clay	783,053	1,258,087	Stone, coal.
Clinton	(2)	(2)	Stone.
Cole	130,336	155,175	Sand and gravel, stone, clays.
Cooper	33,630	84,484	Sand and gravel, stone.
Crawford	(2)	(2)	Sand and gravel, clays.
Dade	134,713	(2)	Stone, coal.
Dallas		11,625	Sand and gravel.
Daviess	141,987	(2)	Sand and gravel, coal.
De Kalb	(2)	(2)	Stone.
Dent	(2)	7,275	Sand and gravel.
Douglas	(2)	5,475	Do.
Dunklin	(2)	(2)	Do.
Franklin	278,266	927,532	Sand and gravel, stone, clays.
Gasconade	3,823,549	1,988,024	Clays, stone, sand and gravel.
Gentry		(2)	Sand and gravel, stone.
Greene	1,645,092	2,184,998	Stone, lime, sand and gravel.
Grundy	(2)	(2)	Stone.
Harrison	224,288	354,208	Stone, sand and gravel, coal.
Henry	2,795,832	(2)	Coal, stone.
Hickory		(2)	Stone, sand and gravel.
Holt	(2)	393,590	Stone.
Howard	(2)	88,826	Stone, sand and gravel.
Howell	67,439	55,788	Stone, sand and gravel, iron ore.
Iron	(2)	219,810	Stone, sand and gravel.
Jackson	6,398,607	7,187,355	Cement, stone, sand and gravel, clays.
Jasper	3,278,556	2,665,518	Stone, sand and gravel, zinc, lead.
Jefferson	857,468	971,052	Sand and gravel, stone.
Johnson	1,095,704	(2)	Stone, coal.
Knox	(2)	(2)	Stone.
Laclede		(2)	Stone, sand and gravel.
Lafayette	255,962	165,013	Coal, sand and gravel, stone, clays.
Lawrence	(2)	(2)	Stone, sand and gravel.
Lewis	356,933	421,589	Sand and gravel, stone.
Lincoln	285,680	394,865	Clays, stone, sand and gravel.
Linn	(2)	208,023	Stone.
Livingston	354,934	305,716	Stone, sand and gravel, clays.
Macon	2,569,291	(2)	Coal, stone.
Madison	5,424,006	4,682,438	Lead, copper, sand and gravel, silver.
Maries	91,115	(2)	Clays, sand and gravel.
Marion	567,837	544,980	Lime, stone, sand and gravel.
McDonald	(2)	1,425	Sand and gravel.
Mercer	(2)	(2)	Stone.
Miller	58,702	30,634	Sand and gravel, barite, stone.
Mississippi		1,650	Sand and gravel.
Moniteau	(2)	53,439	Stone, sand and gravel.
Monroe	150,344	113,882	Clays, sand and gravel, coal, stone.
Montgomery	848,791	415,241	Clays, sand and gravel, stone.
Morgan	(2)	133,587	Sand and gravel, barite, stone.
New Madrid		(2)	Sand and gravel.
Newton	779,165	497,899	Lime, zinc, stone, lead.
Nodaway		(2)	Stone, sand and gravel.
Oregon	(2)	63,550	Iron ore, stone, sand and gravel.
Osage	539,256	77,379	Clays, sand and gravel.
Ozark	(2)	64,403	Iron ore, sand and gravel.
Pemiscot	(2)	(2)	Sand and gravel.
Perry	(2)	(2)	Stone.
Pettis	358,867	628,442	Stone, sand and gravel.

See footnotes at end of table.

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TABLE 20.—Value of mineral production in Missouri, 1953–54, by counties [1]—Con.

County	1953	1954	Minerals produced in 1954 in order of value
Phelps	(2)	$214,424	Clays, stone, sand and gravel.
Pike	(2)	187,485	Stone, sand and gravel.
Platte	$644,134	939,495	Clays, stone.
Polk	(2)	10,875	Sand and gravel.
Pulaski		(2)	Do.
Putnam	63,008	(2)	Coal.
Ralls	(2)	5,159,256	Cement, coal, sand and gravel, stone.
Randolph	944,584	(2)	Coal, stone.
Ray	149,196	177,895	Stone, coal.
Reynolds		6,225	Sand and gravel.
Ripley	(2)	25,427	Do.
St. Charles	902,670	979,057	Sand and gravel, stone.
St. Clair	845,132	(2)	Coal, stone, sand and gravel.
St. Francois	35,228,783	34,423,010	Lead, iron ore, lime, stone, zinc, copper, silver, sand and gravel.
Ste. Genevieve	(2)	(2)	Lime, stone, sand and gravel.
St. Louis	18,332,962	24,078,931	Cement, sand and gravel, stone, petroleum, clays.
Saline	(2)	298,899	Stone.
Scotland	(2)	(2)	Do.
Scott	(2)	10,000	Sand and gravel.
Shannon	41,037	63,100	Iron ore, manganese ore, sand and gravel, stone.
Shelby	(2)	(2)	Stone.
Stoddard	(2)	155,088	Sand and gravel.
Stone		3,300	Do.
Sullivan	(2)	(2)	Stone.
Taney		12,000	Sand and gravel.
Texas	(2)	(2)	Stone, sand and gravel.
Vernon	276,411	130,699	Coal, native asphalt, sand and gravel.
Warren	262,319	415,075	Clays, stone, sand and gravel.
Washington	3,293,647	4,184,459	Barite, lead, zinc, sand and gravel.
Wayne	94,377	123,246	Sand and gravel, stone.
Webster		(2)	Do.
Worth		(2)	Stone.
Wright	(2)	(2)	Stone, sand and gravel.
Undistributed	18,022,468	22,524,118	
Total	128,207,000	131,280,000	

[1] The following counties are not listed because no production was reported: Chariton, Schuyler.
[2] Value included with "Undistributed."

Barton.—The county ranked fifth in the State in the production of coal. Coal was mined by the Clemens Coal Co., N. Coal Co., Inc., D. O. Short Coal Co., Star Coal Co., and the Barbero & Mullani Coal Co.

Bates.—The county ranked third in the State in the production of coal, with coal mined by Hume-Sinclair Coal Mining Co., I. E. Mullies Coal Co., Brotherton & Reedy Coal mine, and Leroy Heckadon coal mine. Crushed limestone was produced for concrete, road metal, and agricultural purposes by Fuller Lime Co., Arthur R. Alvis, and Frank Underwood. Gravel was obtained by Clyde S. Miller from deposits in the county.

Benton.—Structural, paving, and other gravel was produced by Junge Gravel Co. The Missouri State Highway Department contracted for paving gravel.

Bollinger.—Paving gravel was contracted for by the Missouri State Highway Department from deposits in Bollinger County.

Boone.—Adrian Materials Co., N. R. Garrett, Boone Quarries, Inc., and the United States Army Corps of Engineers produced crushed limestone for riprap, concrete, road metal, agricultural, and other purposes. Operations centered near Columbia and Jefferson City. Structural, paving, and filter sand and structural and paving gravel were produced. Producers included Adrian Materials Co., Columbia

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Sand & Towing Co., N. R. Garrett, and the Columbia Special Road District. Coal was mined by Hughes Coal Co., House coal mine, and Earl Hussey coal mine. Columbia Brick & Tile Co. produced shale and fire clay for use in the manufacture of heavy clay products.

Buchanan.—Structural, paving, and engine sand was produced by Pioneer Sand Co. Limestone was produced for concrete, road metal, and agricultural purposes by Everett Quarries, Inc., and for use as riprap by the United States Army Corps of Engineers. Shale was quarried and processed locally into tile and common building brick by Moorhead Brick & Tile Co.

Butler.—Porter De Witt Construction Co. quarried and crushed limestone for concrete and road metal purposes. Grobe & Sons produced structural sand, structural gravel, and paving gravel from steam beds.

Caldwell.—Crushed limestone for concrete, road metal, and agricultural purposes was quarried near Kingston and Nettleton by Farmers Rock & Lime Co. and Houghton Stone. The United States Army Corps of Engineers produced limestone for use as riprap.

Callaway.—Callaway County ranked second in the production of clays in Missouri. Flint and plastic fire clays were mined within the county and manufactured locally into refractories. Producers included Harbison-Walker Refractories Co., Walsh Refractories, Clayton & Crowson, Laclede-Christy Co., and A. P. Green Fire Brick Co. Limestone for concrete and road metal purposes was quarried and crushed by the Auxvasse Stone & Gravel Co. Callaway County Highway Department produced and contracted for paving gravel. The Missouri State Highway Department contracted for paving sand and gravel. Coal was mined by Mariott-Reed Coal Co.

Camden.—The Missouri State Highway Department contracted for paving gravel in Camden County in 1954.

Cape Girardeau.—Cape Girardeau County ranked fifth in the value of mineral production in Missouri in 1954. Cape Girardeau Sand Co. dredged sand from the Mississippi River for structural and paving purposes. Penzel Construction Co. operated a portable plant and obtained paving gravel along the Mississippi River. Limestone was quarried and crushed for concrete, road metal, railroad ballast, and agricultural purposes by Leo Baker, Farmers Limestone Co., and Federal Materials Co. Ceramo Co. and Kasten Bros. Brick Co. mined common red clay for use in the manufacture of building brick. Marquette Cement Manufacturing Co. produced clay and limestone for the manufacture of cement.

Carroll.—M. M. Green Quarry Co. produced crushed limestone for riprap, concrete, road metal, and agricultural purposes. The United States Army Corps of Engineers produced crushed limestone for concrete and road metal purposes.

Carter.—The Missouri State Highway Department produced and contracted for gravel in Carter County for paving purposes.

Cass.—Limestone was quarried and crushed near Peculiar and Harrisonville for concrete, road metal, and agricultural purposes. Producers included Deitz Hill Development Co., Peculiar Rock & Lime Co., McKee Quarries, Emmett Brasnahan, and S & W Quarries. Dimension limestone for use as rubble was produced by S & W Quar-

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ries near Garden City. United Brick & Tile Co. mined clay for the manufacture of brick and tile.

Cedar.—The Missouri State Highway Department contracted for paving gravel in Cedar County in 1954. Sac River Lime Co. produced crushed limestone from sources near Stockton for agricultural purposes.

Christian.—Gene Haworth and the Missouri State Highway Department obtained paving gravel from deposits in Christian County. Limestone was quarried near Billings by Joe Howard for use as a soil conditioner.

Clark.—Limestone was quarried and crushed by Myron Baker, near Kahoka, and Brooks quarry for concrete, road metal, and agricultural purposes.

Clay.—Clay County ranked fourth in the State in the production of stone. Limestone was quarried and crushed for use as riprap, concrete, road metal, and agricultural limestone by Mid-West Precote Co., Tobin Quarries, Inc., Oldham Stone Co., Everett Quarries, Inc., Clay County Highway Department, and the United States Army Corps of Engineers. Coal was mined by Mosby Coal Co. and Perry Rice Coal Co.

Clinton.—Jack Johnson produced crushed limestone for use as concrete and road metal. Everett Quarries, Inc., produced crushed limestone for riprap, concrete, road metal, and agricultural purposes.

Cole.—Structural and paving sand and gravel were obtained along the Osage and Missouri Rivers by Jefferson City Sand Co., Adrian Materials Co., Inc., Thompson Sand Co., Cole County Highway Department, and the Missouri State Highway Department. Limestone for agricultural purposes and other uses was quarried near Eugene by Franklin Groose. Dawson Brick Co. mined miscellaneous clay in Cole County.

Cooper.—Missouri River Sand & Gravel Co. produced structural, paving, and blast sand. The Missouri State Highway Department, Herman Harms, and Ralph Reuter produced paving gravel. The United States Army Corps of Engineers quarried and crushed limestone near Boonville for use in bank stabilization along the Missouri River.

Crawford.—The Missouri State Highway Department contracted for paving gravel in Crawford County in 1954. Arthur L. Nicks mined fire clay for use in the manufacture of firebrick and block.

Dade.—Limestone was quarried and crushed for concrete, road metal, and agricultural purposes by George M. Baker. Coal was mined from open-pit operations in Dade County by Windes & Tyler.

Dallas.—The Missouri State Highway Department produced and contracted for paving gravel in Dallas County in 1954.

Daviess.—Paving sand and gravel was produced by Snyder Quarries, Inc. Winston Coal Mining Co. mined coal from deposits in Daviess County.

De Kalb.—Everett Quarries, Inc., produced crushed limestone near Cameron for riprap, concrete, road metal, and agricultural purposes.

Dent.—The Missouri State Highway Department produced and contracted for paving gravel.

Douglas.—Paving gravel was produced and contracted for by the Missouri State Highway Department.

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Dunklin.—Wilkey & Langford and A. W. Wilkey produced paving gravel from local stream beds in Dunklin County in 1954.

Franklin.—The county ranked third in the State in the production of sand and gravel. Glass, structural, paving, grinding and polishing, filter, and other sands and structural, paving, and railroad ballast gravel were produced. The five leading producers were St. Louis Material & Supply Co., Pacific Pebbles, Inc., Union Sand & Gravel Co., Meramec Sand & Gravel Co., and Koch Laughlin. Limestone and dolomite for concrete, road metal, and agricultural purposes was quarried by Oliver L. Taetz Co., Inc., Edwin Bebermeyer, Julius Grapethin, W. I. Bramel, Tourville Lime Co., J. E. McKeever, and the United States Army Corps of Engineers. Fire clay for use in the manufacture of refractories was mined by Theo Langenberg Mining Co., Laclede-Christy Co., and Rousset Bros. Clay Co.

Gasconade.—This county ranked first in the State in the production of clays. Flint and diaspore fire clays were produced in the vicinity of Swiss, Hermann, Bland, and Owensville and used mainly in manufacturing refractories. Producers included Harbison-Walker Refractories, A. P. Green Fire Brick Co., Walsh Refractories, and Laclede-Christy Co. General Chemical Division of Allied Chemical & Dye Corp. mined clay for chemical uses. Gene McClain, Virgil Smith, and the United States Army Corps of Engineers produced crushed limestone for concrete, road metal, and agricultural purposes. The Missouri State Highway Department contracted for paving gravel in Gasconade County.

Gentry.—Structural sand and paving gravel were produced by Albany Gravel Co. from deposits in Gentry County. H. V. Windsor produced crushed limestone for concrete, road metal, and agricultural purposes.

Greene.—Greene County ranked third in the State in the production of lime and fifth in the production of stone. Limestone was quarried at Galloway and Springfield by Ash Grove Lime & Portland Cement Co. and converted into quick and hydrated lime at the quarry sites. Crushed limestone for concrete, road metal, and agricultural purposes was produced by Garrett Construction Co., James J. Griesemer, G. B. Mason, and George M. Baker. Dimension limestone for rough architectural purposes was quarried by E. L. Britain. Dimension marble was produced by the Carthage Marble Co. The Missouri State Highway Department contracted for paving gravel.

Grundy.—Crushed limestone for riprap, concrete, road metal, agricultural, and other purposes was produced by E. E. Trenary and Jay Wilcox.

Harrison.—Limestone was quarried and crushed near Bethany and Ridgeway for concrete, road metal, and agricultural purposes by Snyder Quarries, L. W. Hayes, Inc., Emmett Mathes, and Interstate Limestone Products Co. The Harrison County Highway Department produced paving sand. New Black Diamond Coal Co. mined coal in Harrison County.

Henry.—This county ranked first in coal production in Missouri in 1954. Producers included Crowe Coal Co., Power Coal Co., Windsor Coal Co., Crowder Coal Co., Hilty Coal Co., Hugh Johnson, A. H. Manbeck Coal Co., A. G. Pence Coal Co., Redding Coal Co., and W. W. Coal Co., Inc. Crushed limestone for concrete, road metal, and

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agricultural purposes was produced by Williams Rock Co., Arthur R. Alvis, Davis Rock Co., and O. A. Knisley. Rough construction dimension limestone was produced by Davis Rock Co.

Hickory.—Limestone for agricultural purposes was obtained from deposits in Hickory County by Roy Worthington. The Missouri State Highway Department contracted for paving gravel.

Holt.—Gordon Bros. Quarries, Inc., and the United States Army Corps of Engineers quarried and crushed limestone for use as road metal and agstone and for bank stabilization along the Missouri River.

Howard.—Hall & Riley produced crushed limestone for concrete, road metal, and agricultural purposes. The United States Army corps of Engineers and the Armstrong Special Road District produced crushed limestone for riprap and road-building purposes. Sand for structural purposes was produced by Glasgow Sand Co.

Howell.—Limestone was quarried near West Plains by Kilkenny Limestone Co. for concrete, road metal, and agricultural purposes. Paving sand and gravel was produced by the Missouri State Highway Department. Iron ore was mined south of West Plains by Lee Johnson.

Iron.—Crushed granite for use as riprap and dimension granite for rough architectural purposes was produced near Graniteville by the Heyward Granite Co. Duncan Bros. quarried dolomite for use as a soil conditioner. The Missouri State Highway Department contracted for paving gravel.

Jackson.—Jackson County ranked first in stone output and fourth in total mineral production. Dimension limestone for use mainly as rubble was quarried by Gerald Hodgins Building Rock Co., Excelsior Springs Rock Co., Strongs Quarries, and Reese Quarries. Limestone was crushed for concrete, road metal, and agricultural purposes. Producers included Stewart Sand & Material Co., Beyer Crushed Rock Co., Centropolis Crusher Co., Union Quarries, Inc., and Rock Acres Developing Co., Inc. Structural, paving, and engine sand and paving gravel were produced by Stewart Sand & Material Co. and Kansas City Quarries. Miscellaneous clay was mined by United Brick & Tile Co. and used in the manufacture of heavy clay products. Missouri Portland Cement Co. quarried limestone and shale near Independence for use in manufacturing cement.

Jasper.—Jasper County ranked third in the State in stone production and fourth in sand and gravel production. Crushed limestone, used mainly for concrete, road metal, and agricultural purposes, was produced by Geo. M. Baker, Carthage Marble Corp., Carthage Crushed Limestone Co., and Independent Gravel Co. Dimension limestone was quarried near Carthage by Carthage Marble Corp. Paving sand and gravel was produced by Kansas City Quarries, and structural paving and engine sand was produced by Independent Gravel Co. Zinc and lead ores were mined and milled in the Alba-Neck City and Webb-Carterville districts. Producers included American Zinc, Lead & Smelting Co. and W. A. Hughes. Chats from zinc-lead mining operations were used as railroad ballast and paving material.

Jefferson.—Jefferson County ranked second in production of sand and gravel in the State. High-purity silica sand, obtained from quarries in the St. Peter formation by AuBuchon Silica Mining Co. near

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Festus and Pittsburgh Plate Glass Co. near Crystal City, was used in manufacturing plate glass and for grinding and polishing purposes. Sand was also produced by Walter Ficken and Masters Bros. Silica Sand Co. Limestone and dolomite were quarried by Henry Trautman, Kitson Bros. quarry, and Hess Bros., for concrete, road metal, and agricultural purposes. Rough construction dimension limestone was produced by Hess Bros. Crushed marble was produced by Giudicy Marble Terrazzo & Tile Co.

Johnson.—Dietz Hill Development Co. and Roop quarries produced crushed limestone for concrete, road metal, and agricultural purposes. Coal was mined by open-pit operations by Herman Smith.

Knox.—McSorley Lime Co. obtained limestone from its quarry near Edina for concrete, road metal, and agricultural purposes.

Laclede. The Missouri State Highway Department contracted for paving gravel in Laclede County in 1954. Limestone for agricultural purposes was quarried and crushed by Wissbaum quarry.

Lafayette.—Coal was mined from underground operations by Ashford Coal Co., Goring & Helliker, Hartwig Coal Co., David Hughes Coal Co., H. S. Peek Coal Co., Henry Roscher Coal Co., and Winfrey Mining Co. Lexington Sand & Gravel Co. and Waverly Sand Co. operated dredges to obtain paving sand near Lexington and Waverly. Limestone for concrete and road metal was quarried near Higginsville by Dietz Hill Development Co. Higginsville Brick & Tile Co. obtained clay and shale for use in manufacturing heavy clay products.

Lawrence.—Geo. M. Baker quarried and crushed limestone for agricultural purposes. The Missouri State Highway Department contracted for paving gravel in Lawrence County.

Lewis.—Missouri Gravel Co. obtained sand and gravel from deposits near LaGrange for paving purposes. Limestone used mainly for concrete, road metal, and agricultural purposes was quarried and crushed by Hamill Limestone Co., Producers Material Co., and Missouri Gravel Co.

Lincoln.—Harbison-Walker Refractories produced firebrick from clays obtained in Lincoln County. Tile products were manufactured near Winfield from local clay by Cecil M. Birkhead tile factory. Limestone for riprap, concrete, road metal, and agricultural purposes was produced by Columbia quarry, Watson quarry, and Duncan Gessman. The Missouri State Highway Department contracted for paving gravel.

Linn.—Baily Limestone Co. quarried and crushed limestone for concrete, road metal, and agricultural purposes. The Linn County Highway Department produced crushed limestone for use on county road projects.

Livingston.—Limestone for riprap, concrete, road metal, railroad ballast, and agricultural purposes was produced by Cooper Contracting Co., Frank Trager, and Fred McVey. Paving sand and paving and structural gravel was obtained and washed by Cooley Gravel Co. at its fixed preparation plant near Chillicothe. Clay for use in manufacturing brick and tile was mined by Midland Brick & Tile Co.

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Macon.—Macon County ranked sixth in the State in the production of coal. Coal was mined by Bevier Coal Co., Rock Branch coal mine, Ahlbom Coal Co., Bertram Miles, Lewellyn coal mine, and R. W. Loumaster. L & O Quarry & Construction Co. quarried and crushed limestone for concrete, road metal, and agricultural purposes.

Madison.—Ores containing silver, copper, and lead were mined by Mine La Motte Corp. near Mine La Motte and the National Lead Co. near Fredericktown. The Missouri State Highway Department contracted for gravel for paving purposes.

Maries.—Diaspore and burley clays were mined in Maries County by Paul R. Litton and Laclede-Christy Co. for use in the manufacture of refractories. The Missouri State Highway Department contracted for gravel for paving purposes.

Marion.—Marion County was the State's fifth largest producer of lime. Quicklime and hydrated lime were produced by Marblehead Lime Co. at its kiln near Hannibal from limestone quarried nearby. Limestone was also used for agricultural and other purposes. Bolton Sand & Gravel Co. produced structural and blast sand.

McDonald.—The Missouri State Highway Department contracted for gravel for paving purposes in McDonald County in 1954.

Mercer.—Limestone used as road metal and soil conditioner was quarried and crushed by Gene McClain.

Miller.—Eldon Mining Co. mined barite near Etterville. Dimension limestone was quarried near Brumley by Al Elam, Inc., for use as rubble, dressed stone, curbing, and flagging. The Missouri State Highway Department contracted for paving gravel.

Mississippi.—The Missouri State Highway Department contracted for gravel for paving purposes.

Moniteau.—Limestone was quarried and crushed by the Moniteau County Agricultural Association for railroad ballast and agricultural purposes and by the United States Army Corps of Engineers for use as riprap. The Missouri State Highway Department contracted for paving gravel.

Monroe.—Paving sand was produced by the Monroe County Highway Department and paving gravel was produced by Wilkerson Bros. and the Missouri State Highway Department. Fire clay, diaspore, and burley clays were mined by Walsh Refractories Corp., Bethlehem Co., Gilliam Mining Co., and Fleutsch Bros. and used mainly for manufacturing refractories. Limestone was quarried and crushed for agricultural purposes by Ullmer Wilkerson and for concrete and road metal by the United States Army Corps of Engineers. Coal was mined in Monroe County by Pat Vincent coal mine.

Montgomery.—Fire clay was mined from local pits for use in manufacturing refractories. Producers included Wellsville Fire Brick Co., Forest Johnson, Staley & Zimmerman, A. P. Green Fire Brick Co., and Mary A. Dixon & Co. Sand and gravel for structural and paving purposes was produced by Two Rivers Sand & Gravel Co., Lee Harrison, Montgomery County Highway Department, and the Missouri State Highway Department. Limestone was quarried and crushed for concrete, road metal, and agricultural purposes by McClain Lime Quarry and for use as riprap by the United States Army Corps of Engineers.

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Morgan.—Paving gravel was produced by Dunstan & Yows and the Missouri State Highway Department. L. A. and Carl Campbell mined barite from deposits near Versailles. Limestone was quarried and crushed for agricultural purposes by Harold Campbell.

New Madrid.—The Missouri State Highway Department contracted for gravel for paving purposes.

Newton.—Ores containing zinc and lead were mined in the Stark City district by Dale Mining Co. Southwest Lime Co. manufactured quick and hydrated lime near Neosho from limestone quarried locally. A portion of the limestone was sold for agricultural purposes. Tripoli for use in polishing and buffing compounds was processed at a plant near Seneca. The raw tripoli was obtained from Ottawa County, Okla.

Nodaway.—Limestone was quarried and crushed for concrete, road metal, and agricultural purposes by the Concrete Materials & Construction Co. Structural sand was obtained through dredging operations by the Earl Wilson Sand Co. from deposits near the Platte River.

Oregon.—Brown iron ore was mined by Miller & Reynolds, A. J. Curry, and W. L. Lindley. O. O. Mainprize produced crushed limestone for concrete, road metal, and agricultural purposes. Paving gravel was obtained by the Missouri State Highway Department from local deposits.

Osage.—A. P. Green Fire Brick Co., Harbison-Walker Refractories Co., and Russell Phillips produced fire clay for use in the manufacture of refractories. The Missouri State Highway Department and the Osage County Highway Department produced gravel for paving purposes.

Ozark.—Patillo Bros. and Bowen, Holmes & Battsel mined brown iron ore from deposits in Ozark County. The Missouri State Highway Department contracted for paving gravel.

Pemiscot.—Sand and gravel for structural and building purposes was obtained from deposits near Caruthersville by Taylor Sand & Gravel Co. and Caruthersville Sand & Gravel Co.

Perry.—Limestone was quarried and crushed by Gibbar Bros. for concrete, road metal, and agricultural purposes.

Pettis.—W. J. Menefee Construction Co., T. & O. Lime & Rock Co., and Howard Construction Co. produced crushed limestone for concrete, road metal, and agricultural purposes. Paving gravel was produced by J. C. Orender and W. J. Menefee Construction Co.

Phelps.—Fire clay was mined for use in the manufacture of refractories. Producers included Laclede-Christy Co., Floyd C. Dillon, Robinson Clay Products Co., Dillon Bros. Clay Mining Co., and E. E. Withouse. L. H. Bray, Brown & Lenox, and Jessie Nivens produced crushed dolomite for use as a soil conditioner and in building and road construction. Paving gravel was produced by the Missouri State Highway Department.

Pike.—Limestone was quarried and crushed for concrete, road metal, and agricultural purposes by Magnesium Mining Co., Ashley Quarries, and Galloway Limestone Co. The Missouri State Highway Department contracted for gravel for paving purposes.

Platte.—Platte County ranked third in the State in the production of clays. Miscellaneous clay was mined by the Carter-Waters Corp. for

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use in the production of lightweight aggregates. The United States Army Corps of Engineers used crushed limestone for bank stabilization along the Missouri River. Limestone for concrete and road metal was produced by Gene McClain, Everett Quarries, Inc., and Mid-West Precote Co.

Polk.—The Missouri State Highway Department contracted for gravel for paving purposes.

Pulaski.—J. H. Walser produced sand and gravel near Waynesville for structural and other purposes. The Missouri State Highway Department contracted for paving gravel.

Putnam.—Coal was mined in Putnam County. Producers included Pat Vincent Coal Mine, W. T. Clark Coal Co., Cleo Baugher Coal Co., Hayes Coal Co., Clarence Ledford, Bine Veach, and Alva Wessel.

Ralls.—Universal Atlas Cement Co. manufactured cement at its plant near Ilasco. Limestone and shale for use in cement manufacture were obtained near the plant. Limestone for concrete and road metal was produced by Central Stone Co. Edward B. Cooper obtained paving gravel from local deposits. Coal was mined at open-pit operations by J. W. Couch Coal Mine and Clarence D. Day.

Randolph.—The county ranked second in coal production; the producers were Moberly Fuel Co., Bradley Coal Co., Inc., Fately Coal Co., and Nejedley Coal Co. Limestone was quarried and crushed for concrete, road metal, and agricultural purposes by N. J. Cooksey, Glasgow Quarries, Inc., Ralph Potter quarry, and Alfred Vanskike Lime Quarry.

Ray.—Crushed limestone, produced by Steva Stone Co. near Richmond and Orrick Stone Co. near Orrick, was used for concrete, road metal, and agricultural purposes. The United States Army Corps of Engineers produced crushed limestone for use as riprap. Coal was mined in Ray County by East Side Coal Co., Smith & Palmer coal mine, and Little Creek coal mine.

Reynolds.—Paving gravel was produced and contracted for by the Missouri State Highway Department.

Ripley.—Structural and paving sand and gravel and railroad ballast gravel were produced by the T. L. Wright Lumber Co. Paving gravel was contracted for by the Missouri State Highway Department.

St. Charles.—St. Charles County ranked fifth in the State in the production of sand and gravel. Glass, molding, structural, fire, and other sands were produced by the Tavern Rock Sand Co. Paving gravel was produced by the Missouri State Highway Department and the St. Charles County Highway Department. Limestone was quarried and crushed for use as riprap and for concrete, road metal, and agricultural purposes by St. Charles Quarry Co., O'Fallon Quarry, Hemsath Quarry, Joerling Bros., Schiermeier Lime Quarry, and the United States Army Corps of Engineers. O'Fallon Quarry produced dimension limestone mainly for use in rough construction.

St. Clair.—This county ranked fourth in coal production. Pioneer Mining Corp., Clary Coal Co., Stoneman Bros. Coal Co., and Osage Coal Co. were the principal producers. Hunt Limestone Co. quarried and crushed limestone for agricultural, concrete, and road-metal purposes. Paving and other gravels were produced by the Missouri State Highway Department and Herman Schneider.

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St. Francois.—Hematite iron ore was mined at Iron Mountain by Ozark Ore Co., and shipped to steel furnaces. Ores containing silver, copper, lead, and zinc were milled by St. Joseph Lead Co. Chats from lead- and iron-mining operations were used for railroad ballast, road metal, and agricultural purposes. Dolomite was produced by St. Joseph Lead Co. and Valley Dolomite Corp. and used as flux and for concrete, road metal, and agricultural purposes. Valley Dolomite Corp. produced lime for use as refractory material.

Ste. Genevieve.—Mississippi Lime Co. of Missouri produced quick and hydrated lime for chemical, industrial, and building purposes at its plant near Ste. Genevieve. Limestone was sold for glass, whiting, asphalt filler, coal dust, poultry grit, and various purposes. Dimension marble was produced by Tennessee Marble Co. Structural sand and paving gravel was produced by Bauman Bros., Contractors.

St. Louis.—Limestone quarries near Lemay, Maplewood, and Clayton supplied material for road metal, riprap, and agricultural purposes. The leading crushed-limestone producers were Rock Hill Quarries Co., Vigus Quarries, West Lake Quarry & Materials Co., Riverview Stone & Materials Co., Bussen Quarries, Inc., and Des Peres Quarry. Rough dimension limestone quarried by the West Lake Quarry & Materials Co. and F. Ruprecht & Sons quarry was used as foundation stone and flagging. St. Louis County ranked first in the production of cement and sand and gravel. Cement was produced near Lemay by Alpha Portland Cement Co. and near Prospect Hill by Missouri Portland Cement Co. Sand and gravel for glass, molding, building, and paving purposes was produced by several operators, including Missouri Aggregates, Inc., Winter Bros. Materials Co., Inc., Dennis Materials Co., St. Charles Sand Co., and Pioneer Silica Products Co. Plastic fire clay and shale were mined by Alton Brick Co., Thomas Mining Corp., Hydraulic-Press Brick Co., and Evans & Howard Sewer Pipe Co. for use in manufacturing refractory brick and heavy clay products. Petroleum was produced in St. Louis County.

Saline.—The United States Army Corps of Engineers produced crushed limestone for use in riprapping the banks of the Missouri River from Diggs and Morrison quarries near Waverly and Miami. Limestone for concrete, road metal, and agricultural purposes was produced by Hall & Riley, Duderstadt Construction Co., and Howard Construction Co.

Scotland.—Limestone was quarried and crushed for railroad ballast and agricultural purposes by Charles E. Peck.

Scott.—The Missouri State Highway Department contracted for paving gravel. Sikeston Concrete Products Co., Inc., obtained sand from deposits along the Mississippi River for building purposes.

Shannon.—Ozark Mining Corp. mined brown iron ore from its Fisher mine. Manganese ore was mined near Eminence by Evans & Parker. The Missouri State Highway Department produced gravel for paving purposes. Limestone for agricultural purposes was produced by H. N. Harrison.

Shelby.—Limestone was quarried and crushed by Turner Lime & Rock quarry near Shelbina for concrete, road metal, and agricultural purposes. The Monroe County Highway Department obtained

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limestone from deposits in Shelby County for road-building purposes.

Stoddard.—Structural and paving sand and gravel were obtained from deposits near Dexter. Producers included the Brown Sand & Gravel Co., Hill & Stuart, Inc., and the Missouri State Highway Department.

Stone.—The Missouri State Highway Department contracted for paving gravel.

Sullivan.—Limestone for concrete, road metal, and agricultural use was produced by Carl Partin and the Bailey Limestone quarry.

Taney.—Paving gravel was contracted for by the Missouri State Highway Department.

Texas.—Long Bros. quarried and crushed limestone for road building and agricultural purposes. The Missouri State Highway Department contracted for paving gravel.

Vernon.—Coal was mined in Vernon County in 1954. Producers included Ellis Coal Co., Schooley Coal & Construction Co., Thornhill Coal Co., K & M Coal Co., and Jones Coal Co. Native asphalt was produced. Paving sand and gravel was obtained from local deposits by county crews for county road maintenance.

Warren.—Fire clay was mined for use in the manufacture of refractories by Harbison-Walker Refractories Co., Wilcoxon & Long, Acme Mining Co., and Wesley Johnson. Limestone was produced for use as riprap by the United States Army Corps of Engineers and for agricultural purposes by Sprick Bros. The Missouri State Highway Department and the Warren County Department of Roads contracted for paving gravel.

Washington.—Barite was produced from mines near Mineral Point, Potosi, Richwoods, Fertile, Palmer, Cadet, and Old Mines. Producers included J. E. Carter Mining Co., Baroid Division of National Lead Co., Midwest Mining Co., and H & P Mining Co. Quantities of galena were recovered in barite mining and washing operations. A. M. Mount produced paving sand and gravel.

Wayne.—Paving sand and gravel and railroad ballast gravel were produced by Keener Gravel Co., Inc. The Missouri State Highway Department contracted for paving gravel. Williamsville Stone Co. produced dimension sandstone for use as rubble and flagging. Limestone was obtained from local deposits for use as flagstone by Wm. Harris & Son Lime quarry.

Webster.—The Missouri State Highway Department produced paving gravel. S. P. Johnson obtained limestone for agricultural purposes.

Worth.—Limestone was quarried and crushed for concrete, road metal, and agricultural purposes by Grand River Limestone Co.

Wright—Thomson Lime Co. produced limestone for concrete, road metal, and agricultural purposes. The Missouri State Highway Department obtained paving gravel from local deposits. Natural gas was produced in Wright County.

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The Mineral Industry of Montana

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, United States Department of the Interior and the Montana Bureau of Mines and Geology.

By Kenneth D. Baber,[1] Frank B. Fulkerson,[1] and Albert J. Kauffman, Jr.[2]

DESPITE substantial advances in the value of output of cement, chromite, natural gas, petroleum, sand and gravel, and tungsten totaling more than $15 million, the decrease in the value of coal, copper, lead, manganese, silver, and zinc of nearly $23 million caused a 5-percent decline in value of mineral production in Montana in 1954. A 53-day strike of the independent International Union of Mine, Mill, and Smelter Workers, which halted all Anaconda Co. operations beginning in late August, was a major factor in the sharp decline in output of copper, lead, silver, and zinc; and the drop in manganese production was attributed to lessened demand in the steel industry, as well as to importation of low-cost foreign ores. Chromite-and tungsten-concentrate output was up markedly from 1953 due to the first full year of operations at properties in Stillwater and Beaverhead Counties, respectively. The increase in the reported value of sand and gravel was due almost entirely to expanded statistical coverage of that basic industry.

Idleness due to work stoppages was the highest since 1934 because of the extended strike at Anaconda Co. operations. In metal mining employment generally follows a counterseasonal trend. The number of workers usually is highest in winter and reaches the low point from May through September after mine workers move to outdoor employment for the summer on ranches, in logging camps and lumber mills, construction, and in other seasonal work. In 1954 employment at metal mines showed the normal pattern in the spring and early summer, declining considerably compared to the early months of the year, but strikes constituted the principal factor causing variations in the monthly totals for the year. The major work stoppage at the Butte mines, which lasted from August 23 to October 18, reduced employment for September and October to 2,700 and 3,900, respectively, compared with the high for the year of 8,900 in January. Although all major metal mines were in production in November and December, the effect of the prolonged strike resulted in a work force in metal mining that was substantially less than comparable 1953 totals for the last 2 months of the year. The annual average was 7,400 workers compared with 8,200 in 1953.

The average number of workers in primary metals processing plants declined slightly from the previous year. Average total employment in coal and other nonmetallic mining also dropped owing to decreased coal production. The number of workers in petroleum-natural-gas production and in petroleum refining remained about the same.

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TABLE 1.—Mineral production in Montana, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Chromite	26,089	$869,968	123,096	$4,132,475
Clays	36,994	38,312	(2)	(2)
Coal:				
Bituminous	1,848,334	4,884,209	1,490,846	4,157,325
Lignite	24,803	93,551	(2)	(2)
Copper (recoverable content of ores, etc.)	77,617	44,552,158	59,349	35,015,910
Fluorspar	5,932	(2)	15,102	(2)
Gold (recoverable content of ores, etc.)—troy ounces	24,768	866,880	23,660	828,100
Iron ore (usable)—long tons, gross weight	6,709	45,083	6,473	(2)
Lead (recoverable content of ores, etc.)	19,949	5,226,638	14,820	4,060,680
Manganese ore (35 percent or more Mn) gross weight	113,429	(2)	58,661	(2)
Manganiferous ore (5 to 35 percent Mn)—do	5,598	(2)	5,286	(2)
Natural gas—million cubic feet	27,889	1,645,000	30,252	2,057,000
Petroleum (crude)—thousand 42-gallon barrels	11,920	26,020,000	[4] 14,195	[4] 31,230,000
Pumice and pumicite	3,000	15,000	175	920
Sand and gravel	6,203,480	2,993,575	13,340,544	7,460,260
Silver (recoverable content of ores, etc.)—troy ounces	6,689,556	6,054,386	5,177,942	4,686,299
Stone (except limestone for cement and lime)	[4] 802,735	[4] 1,124,731	1,319,829	1,385,239
Tungsten concentrate—60-percent WO_3 basis	14	(2)	678	(2)
Zinc (recoverable content of ores, etc.)	80,271	18,462,330	60,952	13,165,632
Undistributed: Antimony ore and concentrate (1953), barite, cement, gem stones (1954), gypsum, lime, sheet mica (1954), natural-gas liquids, phosphate rock, pyrites, stone (dimension granite, 1953), talc, vermiculite, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2)	----------	19,292,629	----------	18,518,856
Total Montana	----------	132,184,000	----------	[5] 126,412,000

[1] Production as measured by mine shipments, sales or marketable production (including consumption by producers).
[2] Value included with "Undistributed."
[3] Lignite production data by States withheld to avoid disclosure of individual company operations.
[4] Excludes certain stone, value for which is included with "Undistributed."
[5] The total has been adjusted to eliminate duplication in the value of raw materials used in manufacturing cement and lime.

Data of the Montana Employment Service also indicate that hourly earnings in all mining averaged $2.15, in metal mining $2.09, and in primary metals processing $1.92, compared with $2.18, $2.14, and $1.95, respectively, in 1953. This decrease in hourly earnings resulted from elimination of overtime in the industry by a shortened week which went into effect early in the year and more than offset the effect of pay raises occurring in 1954. Additional details on earnings and employment are given in tables 2–4.

There was increased activity in Montana in all phases of the construction industry, with the result that the average work force of contractors averaged 9,900 against 9,500 in 1953. Building of an aluminum plant at Columbia Falls and construction on the Tiber Dam on the Marias River south of Chester were the largest projects. During the year the Bureau of Reclamation completed the Canyon Ferry Dam on the Missouri River in Lewis and Clark County. The powerplant at Hungry Horse Dam was placed in full service in 1954. The dam, on the South Fork of the Flathead River in Flathead County, is the fourth largest concrete dam in the United States. A total of 3 million cubic yeards of concrete and 5.6 million tons of sand and gravel was used in its contruction.

The mineral industry was affected by a decision of the Montana Supreme Court on intrastate freight rates; affirming the judgment of a district court, in May 1954, it set aside an order of the Montana State Board of Railroad Commissioners granting a 15-percent increase

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TABLE 2.—Estimated employment in mining, primary metals, and petroleum refining in Montana, 1947–54 [1]

	1947	1948	1949	1950	1951	1952	1953	1954
Mining	9,600	10,200	9,900	10,200	10,400	11,400	11,600	10,600
Metal	6,700	7,200	7,200	7,800	8,000	8,200	8,200	7,400
Bituminous and soft coal	1,000	900	800	700	700	[2] 1,100	[2] 1,000	[2] 800
Petroleum and natural gas	1,400	1,500	1,300	1,200	1,200	2,100	2,400	2,400
Nonmetallic and quarrying	500	600	600	500	500	([3])	([3])	([3])
Primary metals	4,200	4,300	4,300	4,000	3,600	3,600	3,600	3,300
Petroleum refining	([4])	([4])	([4])	([4])	([4])	([4])	1,200	1,200

[1] Includes all full- and part-time wage and salary workers. Excludes proprietors, etc. (Compiled from Montana State Employment Service publications).
[2] Includes nonmetallic mining and quarrying.
[3] Combined with coal mining.
[4] Separate data not published before 1953.

TABLE 3.—Average number of wage earners and total wages in industries covered by Montana employment security act, 1946 and 1950–54 [1]

Year [2]	Total all industries		Mining			
	Average number of wage earners	Wages	Number of employers	Average number of wage earners	Wages	Annual average wage level
1946	83,189	$173,057,776	402	8,886	$25,401,860	$2,859
1950	98,769	271,825,306	463	9,483	31,502,931	3,322
1951	102,853	312,401,996	458	10,561	41,470,947	3,927
1952	102,926	338,291,000	474	10,562	46,941,121	4,444
1953	105,838	362,736,555	517	11,406	53,308,193	4,674
1954	107,018	372,638,135	528	11,635	54,105,365	4,650

[1] Compiled from Montana Unemployment Compensation Commission publications.
[2] 1946 is the calendar year; 1950–54 are fiscal years in this tabulation.

TABLE 4.—Average hours and earnings of workers in selected Montana industries, 1950–54 [1]

	1950	1951	1952	1953	1954
Average weekly earnings:					
All manufacturing	$64.58	$72.13	$79.46	$79.76	$79.20
Primary metals	60.87	75.75	83.99	87.64	75.69
All mining	67.27	79.84	85.74	90.81	81.93
Metal mining	64.98	78.37	85.27	91.23	77.43
Average weekly hours:					
All manufacturing	40.1	41.2	41 0	41.4	39.9
Primary metals	40.4	45.0	45.4	45.1	39.4
All mining	39.1	42.3	41.4	41.6	38.1
Metal mining	38.9	42.6	41.9	42.6	37.1
Average hourly earnings:					
All manufacturing	$1.61	$1.75	$1.86	$1.93	$1.99
Primary metals	1.51	1.68	1.85	1.95	1.92
All mining	1.72	1.89	2.07	2.18	2.15
Metal mining	1.67	1.84	2.03	2.14	2.09

[1] Excludes administrative and salaried personnel. Earnings include overtime and other premium pay. (Compiled from Montana State Employment Service publication).

in rates to the railroads in all intrastate shipments except livestock. The railroad board's order, held to be invalid, had been based on a similar increase in rates and charges for interstate shipments granted the rail carriers operating in Montana by the Interstate Commerce Commission.

Projects of the Defense Minerals Exploration Administration (DMEA) program to assist in the systematic investigation of strategic and critical mineral occurrences are shown in table 5.

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TABLE 5.—Defense Minerals Exploration Administration contracts active during 1954

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
BEAVERHEAD					
Minerals Engineering Co.	Lost Creek	Tungsten	Apr. 17, 1952	$111,280	75
Roberta Wegener	Faithful	Lead, copper	Nov. 4, 1952	17,500	50
BROADWATER					
Edmund E. Pohl, et al.	January	Lead, zinc, copper	Jan. 28, 1952	36,449	50
CASCADE					
Boss Mines, Inc.	Boss & Atlantus	Lead, zinc	Dec. 7, 1954	24,146	50
DEER LODGE AND GRANITE					
Sunshine Mining Co.	Tarlach Group	Tungsten	Sep. 14, 1953	61,355	75
GRANITE					
American Machine & Metals, Inc.	Mullen	Manganese	Dec. 15, 1953	84,610	75
Peter Antonioli	Scratch Awl	Manganese, lead, zinc.	July 28, 1954	128,320	62½
Copper Queen Mining Syndicate.	Sunrise	Copper	Aug. 20, 1953	21,460	50
Taylor-Knapp Co.	True Fissure	Manganese	Feb. 1, 1954	648,727	75
JEFFERSON					
Norman Boe	Bulware	Copper	Nov. 13, 1953	26,730	50
Elkhorn Consolidated	Dunstone	Lead, zinc, copper.	Nov. 22, 1954	26,110	50
Neuberg Bros. & Sloan	Eva Mae	do	June 5, 1953	45,400	50
Radon Research Corp.	Red Rock	Uranium	May 10, 1954	34,175	75
JUDITH BASIN					
Hughesville Silver & Lead Mining Co.	Carter	Lead	Aug. 17, 1951	10,000	50
LEWIS AND CLARK					
Ottawa Tungsten Co.	Prentice	Tungsten	Feb. 24, 1953	47,600	75
MADISON					
Commonwealth Lead Mining Co.	Calvin	Lead	Apr. 28, 1953	61,784	50
POWELL					
Boulder Ores, Inc.	Snowshoe	Tungsten	Aug. 24, 1953	33,600	75
Golden Anchor Mining & Milling Co.	Golden Anchor	Lead, zinc	July 21, 1953	34,716	50
SANDERS					
Elmer and Jessie Allen	Sepey Creek	Copper	Oct. 27, 1952	10,800	50
Amador Mining Co. (assignee of Kootenay Copper Co.).	Green Mountain	do	Feb. 4, 1952	31,900	50
SILVER BOW					
Irving G. Irving & Robert H. Nelson.	Plutus	Manganese	Sep. 21, 1953	25,830	75
West Slope Mining Co.	Birdie	Tungsten	Jan. 29, 1952	10,080	75

In addition to the mineral values credited to Montana in table 1, some are omitted owing to lack of information. Many ores contain valuable minor constituents, such as arsenic, bismuth, cadmium,

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selenium, tellurium, gallium, and germanium. The quantities sometimes are not known and sometimes, though known by analyses, are not accounted for metallurgically in early processing stages or credited to mine or origin. These minor constituents are recovered at plants that frequently treat mixtures of materials from many sources, including residues obtained in other ways. It is not possible in many such instances to distribute the mineral products by States of origin, and sometimes it is even difficult to obtain an accurate separation as to domestic and foreign sources. Another mineral product of value, the production of which usually cannot be separated as to source, is by-product sulfuric acid. The value of uranium produced cannot be credited, inasmuch as such information is not available under existing regulations of the Atomic Energy Commission.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

REVIEW BY MINERAL COMMODITIES

METALS

Aluminum.—According to The Anaconda Co. annual report for 1954, over $32 million was spent during the year on construction of the new Anaconda Aluminum Co. reduction plant at Columbia Falls, Flathead County, bringing total expenditures to nearly $48 million at the close of the year. A decision to install additional pots, for which building space and electrical energy were available, resulted in increasing the plant's estimated capacity from 52,000 tons per year to 60,000. A strike by a carpenter's union delayed construction from April 5 to July 20; however, favorable weather during the fall and winter months allowed near completion of concrete pouring by December 1, and initial production from the plant was scheduled for mid-1955.

Electrical energy for the plant will be obtained from powerhouses at Hungry Horse Dam under a contract with the Bonneville Power Administration; alumina will be purchased from the Reynolds Metals Co. bauxite-processing plant at Corpus Christi, Tex.

Construction of aluminum-rod rolling and fabricating facilities was begun by the Anaconda Wire & Cable Co. at Great Falls, Cascade County. News reports indicated that the new construction, begun in March, would house a $1 million automatic rolling mill in addition to wire drawing and stranding equipment valued at another $1 million.

Chromium.—Production of chromium concentrate, as given in the Goldfield Consolidated Mines Co. (parent company of American Chrome Co.) annual report for 1954, was 118,172 tons, and income from the sale of concentrate to the Government under the company contract was $4,132,474. The total output of concentrate since operations were begun at the Mouat mine in Stillwater County in August 1953 was 144,262 tons. The company contract with the

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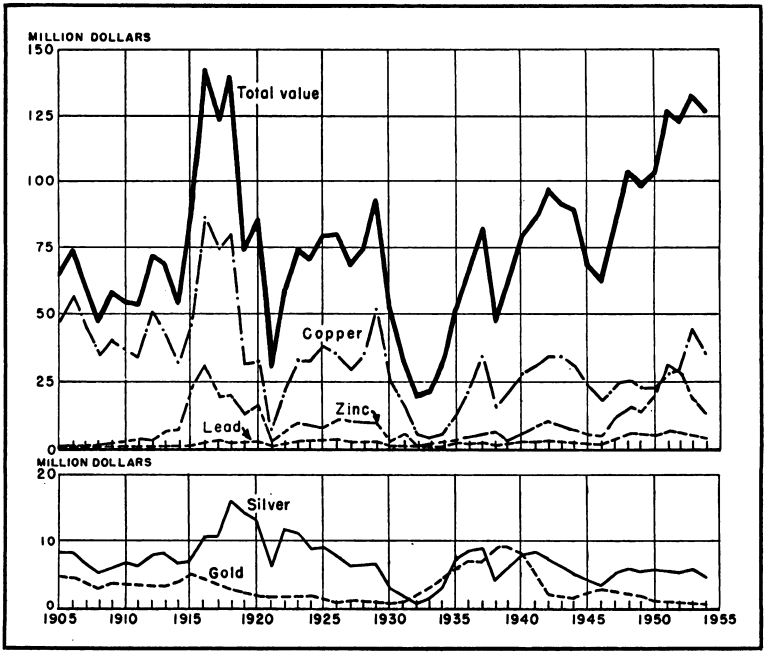

FIGURE 1.—Total value of mineral production and value of gold, silver, copper, lead, and zinc in Montana, 1905–54.

Government calls for production of 900,000 tons of concentrate having a chrome content of 38 percent by December 31, 1961. According to the annual report, the difficult job of separating the chromite from gangue materials with only a slight difference in specific gravity between the two was overcome, and recovery approached 84 percent compared with an anticipated 75 percent when plans for the project were made. Also, the company continued its efforts to further increase recoveries as well as explore the possibilities for making the products of the Mouat property commercial in competition with higher grade imported ores.

News reports described operations at the property as being on a 2-shift, 6-day-week basis at the mine and a 24-hour day, 7-day-week basis at the mill. The company employed 321 men in turning out approximately 1,000 tons of ore and 380 tons of concentrate daily. Payroll costs ran to $1,830,000 in 1954, in addition to expenditure of $897,300 for supplies. A brief history and description of the property and a mill flowsheet were published.[3]

Copper.—After increasing in 1953 to the highest production since 1945, the output of copper declined over 18,000 tons (24 percent). Montana dropped back to fifth place in copper production after ranking third in 1953. The first four States, in order of output of the metal, were Arizona, Utah, Nevada, and New Mexico. A strike of the independent International Union of Mine, Mill and Smelter Workers,

[3] Huttl, John B., How One Chrome Producer Aims at Self-Sufficiency: Eng. and Min. Jour., vol. 155, No. 6, June 1954, pp. 92–95, 101.

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lasting from August 23 to October 18 and idling about 10,000 workers at the Montana operations of The Anaconda Co., was the major factor in the decrease in State production. A curtailment by The Anaconda Co. earlier in the year, after mine production had exceeded consumption of copper for several months, also contributed to the decline in mine output. In the first 7 months of 1954 the State output averaged 6,071 tons compared with 6,411 tons in the same period in 1953, and in September the production dropped to only 29 tons owing to the strike. After the end of the dispute, production was resumed at Butte, but the monthly output in November and December was considerably below the prestrike rate.

In February The Anaconda Co. shut down the Belmont copper mine at Butte and also the Badger State property, which supplied

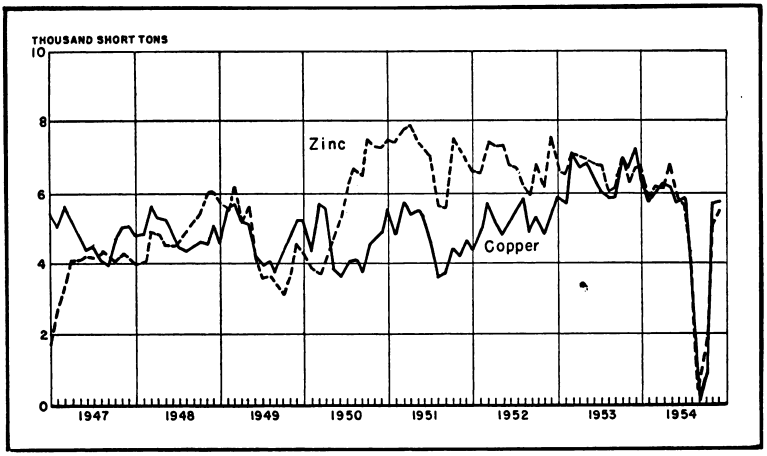

FIGURE 2.—Mine production of copper and zinc in Montana, 1947–54, by months, in terms of recoverable metals.

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc in 1954, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	2,300	608,650	6,424	1,554	6,865
February	1,810	514,660	5,878	1,521	5,995
March	2,310	554,100	6,148	1,502	6,264
April	2,380	506,275	6,217	1,376	6,156
May	2,030	535,850	6,146	1,471	6,843
June	2,220	500,167	5,740	1,474	5,991
July	2,210	493,580	5,944	1,279	5,767
August	1,770	370,250	4,391	1,182	4,095
September	750	57,220	29	400	404
October	1,180	133,990	974	500	1,883
November	2,380	444,950	5,745	1,280	5,126
December	2,320	458,250	5,713	1,281	5,563
Total	23,660	5,177,942	59,349	14,820	60,952

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lead-zinc ore containing byproduct copper. These two mines were idle the rest of the year. Concurrently although the number of workers at the Butte mines and the Anaconda and Great Falls metallurgical plants was maintained at about the same level, the work week for each employee was reduced from 6 days to 5.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc, 1945–49 (average), 1950–54, and total, 1862–1954, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945–49 (average)	225	41	3,174,155	66,209	$2,317,301	5,759,828	$4,918,859
1950	245	39	3,608,036	51,764	1,811,740	6,590,747	5,964,959
1951	198	16	3,965,875	30,502	1,067,570	6,393,768	5,786,683
1952	164	9	4,625,750	24,161	845,635	6,138,185	5,550,367
1953	142	7	6,101,348	24,768	866,880	6,689,556	6,054,386
1954	113	11	5,104,288	23,660	828,100	5,177,942	4,686,299
1862–1954	----------	----------	(3)	17,422,915	394,255,237	799,723,952	592,847,873

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	63,950	$22,949,713	14,159	$4,088,369	38,628	$9,661,704	$43,935,946
1950	54,478	22,662,848	19,617	5,296,590	67,678	19,220,552	54,956,689
1951	57,406	27,784,504	21,302	7,370,492	85,551	31,140,564	73,149,813
1952	61,948	29,982,832	21,279	6,851,838	82,185	27,285,420	70,521,092
1953	77,617	44,552,158	19,949	5,226,638	80,271	18,462,330	75,162,392
1954	59,349	35,015,910	14,820	4,060,680	60,952	13,165,632	57,756,621
1862–1954	7,061,914	2,133,703,028	844,482	122,987,852	2,397,894	438,911,288	3,682,705,278

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings retreated; and ore, old slag, and copper precipitates shipped to smelters during calendar year indicated.
[2] Does not include gravel washed.
[3] Figure not available.

Silver Bow County produced 99 percent of the copper output of the State. In addition to The Anaconda Co. production, copper ore was produced by Norman Rogers from the Rabbit, Bertha, and Bullwhacker open-pit mines east of Butte, and Ted Farrow operated the Sarsfield mine in the same area. Output from these mines was processed by the copper smelter at Anaconda.

Copper-bearing materials shipped in 1954 from Butte to the metallurgical plant at Anaconda comprised high-grade ore from the Mountain Con, Leonard, and Belmont mines; special waste from the same properties; low-grade oxide copper ore produced by block-caving methods at the Kelley mine of the Greater Butte project, which reached the production stage in 1952; ore from the Skyrme development project, an open-pit operation based on low-grade oxide ores; mine-water precipitates; and a small tonnage of tailing.

At the new Kelley mine ore-drawing operations were carried out during the year on the 400, 500, and 600 levels. Work on the Kelley No. 2 shaft was substantially completed in 1954. The planned capacity production of 15,000 tons of ore per day can be attained in 1955, when the 1300 level goes into production, according to the company annual report. Additional development work at the Greater

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TABLE 8.—Gold produced at placer mines, 1945–49 (average) and 1950–54, by classes of mines and methods of recovery

Class and method	Mines producing [1]	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	Average value per cubic yard
Surface placers:					
Gravel mechanically handled:					
Bucketline dredges:					
1945–49 (average)	3	3,529,100	14,846	$519,603	$0.147
1950	1	1,128,900	2,946	103,110	.091
1951–54					
Dragline dredges:					
1945–49 (average)	2	275,530	1,539	53,851	.195
1950					
1951	3	692,400	996	34,860	.050
1952	1	250	46	1,610	6.440
1953					
1954	2	82,500	1,394	48,790	.591
Nonfloating washing plants: [2]					
1945–49 (average)	6	325,060	1,660	58,093	.179
1950	6	93,050	287	10,045	.108
1951–52					
1953	3	42,500	1,216	42,560	1.001
1954	2	3,950	79	2,765	.700
Gravel hydraulically handled:					
1945–49 (average)	2	5,060	78	2,737	.542
1950	1	500	13	455	.910
1951	1	2,500	14	490	.196
1952	1	600	9	315	.525
1953–54					
Small-scale hand methods: [3]					
1945–49 (average)	25	6,970	116	4,067	.584
1950	29	9,800	182	6,370	.650
1951	12	3,400	64	2,240	.659
1952	7	2,500	23	805	.322
1953	4	400	7	245	.613
1954	6	1,350	53	1,855	1.374
Underground placers: Drift:					
1945–49 (average)	2	1,020	49	1,729	1.695
1950	2	50	6	210	4.200
1951–53					
1954	1	200	3	105	.525
Grand total placers:					
1945–49 (average) [4]	40	4,143,740	18,294	640,304	.155
1950	39	1,232,300	3,434	120,190	.098
1951	16	698,300	1,074	37,590	.054
1952	9	3,350	78	2,730	.815
1953	7	42,900	1,223	42,805	.998
1954	11	88,000	1,529	53,515	.608

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[2] Includes all placer operations using power excavator and washing plant, both on dry land; an outfit with movable washing plant is termed a "dry-land dredge."
[3] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, etc. "Wet" method used exclusively in Montana.
[4] Includes 6 ounces of gold from Becker-Hopkins dredges.

Butte project increased ore reserves above the 3400 level from 130 million tons to more than 160 million tons, as of December 31, 1954. The company reported that an intensive exploration and development program was underway to find out if Butte copper production could be increased by large-scale, open-pit mining methods. Churn drilling was done in an extensive near-surface, low-grade ore zone southeast of the main Kelley-mine ore areas. The work indicated a potential ore reserve of approximately 100 million tons in this new area. Additional development of this zone was to continue in 1955.

Work was continued on construction of a new crushing plant at Anaconda to handle Kelley-mine ore and on a conveyor leading from

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TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Beaverhead	15	--	534	$18,690	25,075	$22,694
Broadwater	12	1	1,652	57,820	22,704	20,548
Fergus	1	--	14	490	31	28
Flathead	1	--	5	175	200	181
Granite	6	1	382	13,370	332,014	300,489
Jefferson	15	--	1,008	35,280	86,815	78,572
Lewis and Clark	15	1	600	21,000	16,190	14,653
Madison	7	2	47	1,645	370	335
Mineral	2	--	17	595	8,275	7,489
Missoula	2	1	1,340	46,900	34	31
Phillips	1	(1)	2	70	3	3
Powell	4	1	135	4,725	2,820	2,552
Silver Bow	21	1	17,395	608,825	4,663,439	4,220,648
Undistributed [2]	11	3	529	18,515	19,972	18,076
Total	113	11	23,660	828,100	5,177,942	4,686,299

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Beaverhead	12	$7,080	433	$118,642	67	$14,472	$181,578
Broadwater	3	1,770	177	48,498	34	7,344	135,980
Fergus	--	--	--	--	--	--	518
Flathead	--	--	--	--	--	--	356
Granite	11	6,490	391	107,134	1,290	278,640	706,123
Jefferson	15	8,850	384	105,216	181	39,096	267,014
Lewis and Clark	46	27,140	516	141,384	5,342	1,153,872	1,358,049
Madison	--	--	6	1,644	2	432	4,056
Mineral	4	2,360	86	23,564	7	1,512	35,520
Missoula	--	--	3	822	--	--	47,753
Phillips	--	--	--	--	--	--	73
Powell	--	--	35	9,590	10	2,160	19,027
Silver Bow	59,240	34,951,600	11,516	3,155,384	53,527	11,561,832	54,498,289
Undistributed [2]	18	10,620	1,273	348,802	492	106,272	502,285
Total	59,349	35,015,910	14,820	4,060,680	60,952	13,165,632	57,756,621

[1] From property not classed as a mine.
[2] Includes values and quantities which cannot be shown separately for Deer Lodge, Gallatin, Judith Basin, Meagher, Park, Ravalli, and Sanders Counties.

the crushing plant to the concentrator. The ore conveyor will replace 9 miles of railroad haulage.

Gold.—From 1947 to 1954 the production of gold in Montana decreased continuously, except for a nominal gain in 1953, and during the last 3 years of this period the yield was at the lowest rate in State history. A drop of 4 percent was recorded in 1954 as compared with 1953, owing mainly to a decline in ore output from the Butte copper and lead-zinc mines, Silver Bow County, the major source of gold in Montana. Lead-zinc and copper mines supplied 77 percent of Montana's gold output from lode mines. Gold ores, which contributed about 10 percent of the lode production, were recovered from numerous small mines, the following properties being the largest producers in this category: Marietta mine, operated by Al Dance, Park or Indian Creek district, Broadwater County; Gold Coin mine, H. H. Hoben, Georgetown district, Deer Lodge County; and Basin Jib group, Basin Jib Gold Mines, Inc., Cataract (Basin) district, Jefferson

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County. Ore classed as gold-silver yielded 10 percent of the total production. Among the mines in this group were Yellow Band property, Shafer-Renz, Argenta district, Beaverhead County; Alta

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1954, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore:							
Dry gold	24	4,040	2,117	5,718	2,100	24,400	24,400
Dry gold-silver	12	17,875	2,009	117,364	19,000	466,900	256,500
Dry silver	5	489	34	4,997	200	2,200	3,800
Total	41	22,404	4,160	128,079	21,300	493,500	284,700
Copper	12	3,789,454	6,034	1,709,985	110,892,400	----------	200
Copper-lead	1	894	4	9,081	89,400	107,000	55,700
Lead	38	8,600	878	70,043	38,100	2,482,100	282,300
Lead-zinc	16	1,225,661	10,975	3,185,523	4,083,400	25,353,800	109,976,900
Zinc	3	2,994	46	53,915	6,300	191,800	554,300
Total	70	5,027,603	17,937	5,028,547	115,109,600	28,134,700	110,869,400
Other "lode" material:							
Dry silver: Old tailings	1	2,289	--------	13,944	2,000	7,300	38,000
Copper: Precipitates	1	----------	--------	----------	3,548,300	----------	----------
Lead: Mill cleanings	1	6	--------	85	200	1,900	100
Old tailings	1	35	--------	10	----------	4,000	----------
Zinc: Old slag	2	51,951	34	7,222	16,600	998,600	10,711,800
Total	6	54,281	34	21,261	3,567,100	1,011,800	10,749,900
Total "lode" material	113	5,104,288	22,131	5,177,887	118,698,000	29,640,000	121,904,000
Gravel (placer operations)	11	[2]	1,529	55	----------	----------	----------
Total, lode and placer	124	----------	23,660	5,177,942	118,698,000	29,640,000	121,904,000

[1] Detail will not necessarily add to total, because some mines produce more than one class of material.
[2] 88,000 cubic yards.

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation	516	20	----------	----------	----------
Concentration, and smelting of concentrates:					
Ore	17,402	4,946,391	113,183,600	25,733,400	110,537,200
Old tailings	----------	10	----------	4,000	----------
Total	17,402	4,946,401	113,183,600	25,737,400	110,537,200
Direct smelting:					
Ore	4,178	210,207	1,947,300	2,894,800	616,900
Mill cleanings	1	93	200	1,900	100
Old tailings	----------	13,944	2,000	7,300	38,000
Old slag	34	7,222	16,600	998,600	10,711,800
Copper precipitates	----------	----------	3,548,300	----------	----------
Total	4,213	231,466	5,514,400	3,902,600	11,366,800
Placer	1,529	55	----------	----------	----------
Grand total	23,660	5,177,942	118,698,000	29,640,000	121,904,000

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TABLE 12.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties and districts, in terms of recoverable metals

County and district	Mines producing		Material sold or treated (short tons)	Gold (lode and placer) (fine ounces)	Silver (lode and placer) (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer							
Beaverhead County:									
Argenta and Bryant [1]	12		4,001	532	21,621	23,000	828,000	132,000	$172,665
Blue Wing and Chinatown [1]	3		124	2	3,454	1,000	38,000	2,000	8,913
Broadwater County:									
Backer and Beaver [1]	7	1	958	710	19,413	5,400	334,000	54,400	95,646
Cedar Plains and Park or Indian Creek [1]	5		608	942	3,291	600	20,000	13,600	40,334
Fergus County: Warm Springs	1		3	14	31				518
Flathead County: Hog Heaven	1		49	5	200				356
Granite County: Flint Creek	4		26,742	280	331,544	22,000	780,700	2,579,500	701,896
Jefferson County:									
Boulder and Cataract (Basin) [1]	6		2,405	366	2,704	1,000	18,000	13,500	19,476
Clancy and Lump Gulch	4		3,713	128	19,821	3,800	78,300	65,500	41,341
Colorado and Elkhorn [1]	3		10,977	508	64,120	25,200	662,400	279,000	204,127
Whitehall	2		46	6	170		9,300	4,000	2,070
Judith Basin County: Barker	1		307	3	1,319		94,000	6,000	14,825
Lewis and Clark County:									
Heddleston and Helena [1]	4		1,085	41	9,456	89,600	116,700	62,500	59,163
Lincoln, Rimini and Scratch Gravel [1]	6	1	198	92	863	1,400	11,700	11,000	7,205
Madison Gulch	1		153	16	2				562
Marysville	3		1,009	451	5,869	1,000	4,000	7,500	22,750
Smelter	1		50,302				899,600	10,603,000	1,268,369
Madison County:									
Pony and South Boulder and Silver Star [1]	3		58	15	41		700	2,000	874
Rochester	3		80	17	323		11,300	2,000	2,651
Sheridan		1		9	2				317
Tidal Wave	1		2	3	3				108
Washington		1		3	1				106
Mineral County:									
Cedar and Trout Creek	1		60		103	600	3,700	500	831
Keystone	1		1,591	17	8,172	7,400	168,300	13,500	34,689
Missoula County:									
Copper Cliff	1		37		13		6,000		834
Nine Mile	1	1	9	1,340	21				46,919
Phillips County: Little Rockies	1	[2]	5	2	3				73
Powell County:									
Nigger Hill	4		514	132	2,820		70,000	20,000	18,922
Pioneer		1		3					105
Silver Bow County:									
German Gulch		1		70	10				2,459
Summit Valley	21		4,987,849	17,325	4,663,429	118,480,000	23,032,000	107,054,000	54,495,830
Undistributed [3]	12	4	11,403	628	19,123	36,000	2,453,300	978,500	491,687
Total Montana	113	11	5,104,288	23,660	5,177,942	118,698,000	29,640,000	121,904,000	57,756,621

[1] Combined to avoid disclosure of individual output.
[2] From property not classed as a mine.
[3] Includes values and quantities which cannot be shown separately for Georgetown district, Deer Lodge County; Deer Park district, Gallatin County; Alps, Boulder and South Boulder, and First Chance districts, Granite County; Yogo district, Judith Basin County; Beaver and Castle Mountain districts, Meagher County; New World district, Park County; Overwich district, Ravalli County; Eagle and Prospect Creek districts, Sanders County.

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mine, Lahey Leasing Co., Colorado district, Jefferson County; Drumlummon, Brophy & Eden, Marysville district, Lewis and Clark County; and Marget Ann mine, Mitchell Mining Co., Summit Valley (Butte) district, Silver Bow County.

Some increase was recorded in placer-mine production, with output totaling 1,529 ounces compared with 1,223 in 1953. A large share of the placer production was accounted for by E. T. Vincent and Clay Lewis, who operated a dragline dredge in Nine Mile district of Missoula County. Of the placer gold, dragline dredges recovered 91 percent; power excavators and nonfloating washing plants, 5 percent; and small-scale hand methods and drift mining the remainder.

Iron ore.—Iron ore containing approximately 40 percent iron oxide was produced from the Iron Cross mine in Broadwater County by Ralls & Harris Bros. Output was shipped to a cement plant for use in making special-type cements.

Lead.—The yield of lead from Montana mines decreased 26 percent to the lowest in 8 years. A 53-day strike which shut down the Butte mines brought about the sharp drop in production. A contributing factor was closing of two of the Butte mines earlier in the year. The Badger State mine, which produced lead-zinc ore, was closed in February because of low metal prices, and the Travona property, which yielded manganese ore containing lead and zinc, was shut down in July.

Lead-zinc ore supplied 86 percent and lead ore 8 percent of the State total output of lead; most of the remainder was recovered from old zinc slag. The Summit Valley (Butte) district, Silver Bow County, produced 78 percent of the lead mined in the State during the year. Production in the district declined 31 percent from the previous year's total. Base-metal mining in areas outside Silver Bow County remained in a depressed state, although a slight increase in production was made from the low level of 1953. Owing to the closure of numerous small mines in the last 3 years because of the decline in lead-zinc prices that began in 1952, the number of mines producing lead-zinc and lead ores decreased from 88 in 1952 to 44 in 1954.

The principal producing property besides The Anaconda Co. operations was the Jack Waite mine, which was operated under a profit-sharing agreement by American Smelting & Refining Co. The mine is in Sanders County on the Idaho-Montana border at the eastern edge of the Coeur d'Alene mining region. Other lead-producing properties included, by counties and districts: Beaverhead County, Argenta district-Maulden (Hand) mine, operated by Ida B. Hand; Broadwater County, Beaver district-January group, operated by Ed Pohl; Granite County, Flint Creek district-Trout (Algonquin) group, operated by Trout Mining Div. (American Machine & Metals, Inc.), the Peter Antonioli Scratch Awl mine, and the Taylor-Knapp Co. True Fissure property; Jefferson County, Cataract (Basin) district—the Lahey Leasing Co. Alta mine, and, in Elkhorn district—the Elkhorn Queen mine of New Elkhorn Queen, Inc.; and Mineral County, Keystone district—the Nancy Lee lease of E. G. Smith. The Anaconda Co. recovered lead and zinc by treating old slag at the East Helena fuming plant, Lewis and Clark County. Norman Rogers reported production from the

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Mike Horse mine in Heddleston district, Lewis and Clark County. The Mike Horse mine had been dormant after operations were terminated by American Smelting & Refining Co. in 1952. Production was recorded from another old producer, the Montana Standard property in Prospect Creek (Burns) district, Sanders County. This mine, which had been idle for many years, was reopened in the early part of 1953 by Montana Standard Mining Co., Ltd., of Wallace, Idaho. The ore was trucked to the Golconda custom mill near Wallace. In Mineral County, Mineral Leasing Co. was forced to cease operations at the Iron Mountain mine because of low metal prices, and there was no production in 1954.

American Smelting & Refining Co. operated the East Helena lead smelter throughout the year, except from May 6 to June 9 when plant personnel was on strike.

Manganese.—A decreased rate of operations in the steel industry and importation of foreign ores at abnormally low prices were given as factors that resulted in a sharply reduced output of manganese nodules and ferromanganese by The Anaconda Co. in 1954. The company annual report for 1954 shows an output of 60,961 long tons of nodules (compared with 94,120 tons produced in 1953) and 18,012 long tons of ferromanganese (40,764 in 1953). The company also produced 762 long tons of silicomanganese in 1954.

The output of manganese nodules by The Anaconda Co. and of battery-grade oxide-manganese concentrates by the Trout Mining Division, American Machine & Metals, Inc., composed the entire State production of manganese ore and concentrates (over 35 percent Mn). The State totals reflected the sharp decline in output by The Anaconda Co. despite increased production by Trout Mining Division from its Trout-Algonquin property in Granite County. The bulk of The Anaconda Co. nodule shipments was to company ferromanganese plants at Anaconda and Great Falls; smaller quantities were delivered to steel plants and to the National Strategic Stockpile. Battery-grade oxide-manganese concentrates from the Trout Mining Division operation were shipped mainly to the National Strategic Stockpile. Shipments of manganiferous ores and concentrates (less than 35 percent Mn) by Trout Mining Division declined somewhat from the previous year.

High operating costs, together with slackened sales because of the availability of lower price manganese ores on the market, were given as reasons for cessation of operations at The Anaconda Co. Travona mine at Butte. The mine, which was shut down in July, was the oldest mining property in the district. Originally operated as a silver producer, the mine was worked for manganese since World War I and was acquired by The Anaconda Co. in 1928.

The total of shipments from Montana properties to the National Manganese Stockpile depots at Butte and Philipsburg amounted to 56,606 short dry tons valued at $1,202,052, compared with 18,157 short dry tons valued at $541,179 in 1953. Ore shipments were made from mines in Beaverhead, Granite, Jefferson, Missoula, Powell, and Silver Bow Counties. The largest contributors to the total included the Taylor-Knapp Co. True Fissure mine in Granite County and the Lloyd Brynie Nettie-Hubernic mine, the Butte Mines Merger Corp. Minnie Jane mine, and the I. G. Irving and R. H. Nelson Norwich-

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Plutus-Little Sara mine, all in Silver Bow County. Shipments to Government Low-Grade Stockpiles are not included in State production totals until the ore is removed for beneficiation and commercial use.

Silver.—The mine output of silver decreased 1.5 million ounces compared with 1953, reducing the yearly total to the lowest level since 1946. Decreased production at Butte, as the result of a prolonged strike, led to the drop in the State output. Silver was almost entirely a byproduct metal; 97 percent was recovered from ores mined principally for the base metals. Montana continued to be the third-ranking State in silver production; the largest silver-producing States, in order, were Idaho, Utah, Montana, and Arizona.

Butte lead-zinc and copper mines, with several smaller operations in Silver Bow County, supplied 90 percent of all silver produced in Montana during the year. The output of silver in mining areas outside Silver Bow County increased about 115,000 ounces (29 percent) compared with the previous year. A gain in production from the Algonquin property (lead-zine ore) of Trout Mining Division, American Machine & Metals, Inc., in Granite County contributed in large part to this advance.

Tungsten.—The output of tungsten ores and concentrate in the State during 1954 exceeded, by a wide margin, the quantity produced in any former year. The Minerals Engineering Co. operation at the Ivanhoe mine and mill near Glen, Beaverhead County, supplied nearly all (96 percent) of the total of 678 short tons, 60 percent WO_3 basis, recoverable content of ores and concentrate shipped from mines. The company mined 130,357 tons of ore and treated 114,987 tons containing 0.44 percent WO_3 and 110,861 tons of tailing containing 0.07 percent WO_3. A high-grade scheelite concentrate containing over 60 percent WO_3 was shipped to the Minerals Engineering Co. upgrading plant in Salt Lake City, Utah for removal of minor impurities before sale to GSA, and a low-grade product containing less than 10 percent tungstic oxide was shipped to the Salt Lake Tungsten Co. (owned jointly by Minerals Engineering Co. and Sylvania Electric Products, Inc.), where a high-grade synthetic scheelite concentrate was produced. Operations at the Ivanhoe property during most of 1954 were conducted by Minerals Engineering for American Alloy Metals, Inc., under a profit-sharing agreement; however, ownership of the property was acquired late in the year by Minerals Engineering through the purchase of the stock and assets of American Alloy Metals. Estimated reserves in the open-pit mine at the close of the year were 829,000 tons of tungsten ore.

As an indication of the interest in developing the low-grade tungsten deposits in Montana, 15 individuals and companies contributed to that part of the total not accounted for by Minerals Engineering Co. For the most part the operations were very small and consisted of small shipments of ore for pilot mill runs. In Deer Lodge County, Sunshine Mining Co., which was carrying out an exploration program under a $45,000 contract with the DMEA, made a trial shipment of ore from its Storm Lake property to the Contract Milling Co. mill at Walkerville. Sizable shipments were made from the Birch Creek prospect in Beaverhead County to the Minerals Engineering Co. mill at Glen and from the Tip Top mine in Deer Lodge County to the Henderson Tungsten Co. mill in Granite County. Henderson Tungsten Co.

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milled trial shipments of ore from a number of properties and also recovered scheelite concentrates from its own placer operations. Shipments to the newly constructed Mineral Recovery & Engineering Co. custom mill at Osburn, Idaho, were made by Philipsburg Tungsten Co. from the Black Pine (Combination) mine in Granite County.

Uranium.—One DMEA uranium project was active in the State in 1954. In Jefferson County the Radon Research Corp. carried on exploratory work at the Red Block property under a $34,175 contract with the Government. There were numerous reports of radioactive occurrences by individuals and companies using prospecting equipment ranging from small Geiger counters to airborne-survey gear. New evidences of uranium mineralization were reported in Gallatin, Jefferson, Granite, Mineral, and Powell Counties. A quantity of ore was shipped from the A. H. Eiselein & Associates Lone Eagle property in Jefferson County to the Vitro Chemical Co. in Salt Lake City, Utah.

Zinc.—In 1954 Montana dropped to second place in zinc production owing to a sharp 24-percent drop in mine output. From 1951 through 1953 Montana held first place in tonnage of zinc mined, by a wide margin, but production declined in 1954 to 60,952 tons, compared with 61,528 tons in Idaho.

The Butte properties of The Anaconda Co. continued to supply most of the zinc produced by the State mines. Silver Bow County supplied 88 percent of the State total. Production in this county declined nearly 29 percent for the year. In other areas the output advanced 46 percent; however, this was due entirely to a greater quantity of zinc recovered from old smelter slag at the East Helena fuming plant. Material recovered from the old slag was credited to current mine-production statistics for the State. Lead-zinc ore supplied 90 percent of the State production, and old zinc slag yielded nearly all the remainder. The Algonquin property of Trout Mining Division, American Machine & Metals, Inc., Granite County, was the other major producer in the State. Other zinc-producing mines included Maulden (Hand) mine in Beaverhead County; Scratch Awl mine in Granite County; Alta property and Wickes smelter site (old slag), Jefferson County; and Jack Waite property, Sanders County.

At Butte, lead-zinc ore was mined from the Anselmo, Badger State, Lexington, and Orphan Girl mines and shipped by rail to the zinc mill at Anaconda for treatment. The Badger State mine was worked only in the first 2 months of the year. Manganese ore was shipped from the Travona and Emma mines to the Anaconda manganese mill. The mill produced manganese and bulk sulfide (zinc-lead) concentrate. The bulk sulfide concentrate was then treated in the zinc mill.

Miscellaneous Metals.—Byproduct output from The Anaconda Co. refining operations in the State included arsenious oxide, cadmium, and vanadium red-cake precipitates at Anaconda and bismuth, cadmium, indium, palladium, and platinum at Great Falls. According to The Anaconda Co. annual report for 1954, the total production of cadmium (in pounds) was 1,244,416, compared with 1,518,250 in 1953. The report also gives arsenic production as 1,600 and 1,623 short tons in 1954 and 1953, respectively.

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NONMETALS[4]

Barite.—The output of barite by the only producer in the State was considerably less than in 1953. Finlen & Sheridan Mining Co., Butte, continued to operate its mine and processing plant near Greenough, Missoula County. Barite was ground for rotary-drilling mud and crushed for use in sugar refining.

Cement.—Ideal Cement Co., Three Forks Portland Cement Division, the only cement producer in Montana, increased its output over 1953 about 7 percent. The plant, at Trident, Gallatin County, used limestone mined locally and gypsum obtained from a company-owned quarry in Fergus County.

Clays.—The total output and value of clay in the State declined from 1953 by about 15 and 12 percent, respectively. Fire clay was mined in Cascade and Deer Lodge Counties. Miscellaneous clay used for manufacturing structural clay products was produced in Cascade, Fergus, Hill, Powell, and Yellowstone Counties.

Fluorspar.—Shipments of fluorspar from the Crystal Mountain mine almost tripled the 1953 output yet decreased slightly compared with the 1952 total, the first year of operation. The increase resulted from resumed activity at the Columbia-Geneva Division of United States Steel Corp., Geneva, Utah, the principal consumer. S. A. Cummings and H. E. Roberts, Compton, Calif., worked the open pit, 30 miles east of Darby, Ravalli County.

Gypsum.—There was an increase of about 16 percent in the quantity of gypsum mined by the 2 producers in Fergus County. Ideal Cement Co. continued its operation at the underground Hanover mine, and the Shoemaker mine and Heath plant of United States Gypsum Co. were active throughout the year.

Lime.—The output of lime decreased about 19 percent compared with 1953. The Elliston Lime Co., Elliston, Powell County, produced burned and hydrated lime for building and chemical purposes. Limestone shipped from Brown's quarry to The Anaconda Co., Anaconda, Deer Lodge County, was burned to quicklime for use in various plant operations.

Mica.—Data obtained from GSA lot tickets indicated production of mica in Gallatin County during 1954, with output being sold to the GSA for the National Strategic Stockpile.

Phosphate Rock.—The production of phosphate rock was about 3 percent higher in 1954 than in the previous year. This increase was due largely to substantial gains registered by the Montana Phosphate Products Co. Anderson, Graveley, and Luke mines and by George Relyea at his Relyea mine, all in Powell County. Output by the Victor Chemical Works at the Maiden Rock mine, Silver Bow County, and at the Canyon Creek mine, Beaverhead County, was on a reduced scale compared with 1953.

A strike and a plant shutdown due to a structural failure interrupted the manufacture of phosphate products at the Anaconda plant of The Anaconda Co.

Pumice.—Baker Cement Products Co. quarried and prepared a small quantity of pumice at its operation near Baker, Fallon County. The product was used in concrete aggregate for making cement blocks.

[4] Norman S. Petersen, commodity-industry analyst, assisted in preparing this section

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Pyrite.—The production of pyrite at Anaconda by The Anaconda Co. declined almost 30 percent from 1953. The product is recovered from mill tailing resulting from processing Silver Bow County base-metal ores.

Sand and Gravel.—The output of sand and gravel in 1954 was 13,341,000 tons valued at $7,460,000 compared with 6,203,000 tons worth $2,994,000 in 1953. Production was distributed between commercial, 2,451,000 tons ($2,511,000), and Government-and-contractor, 10,889,000 tons ($4,949,000). Comparable figures for 1953 were commercial, 1,179,000 tons ($1,046,000), and Government-and-contractor, 5,024,000 tons ($1,948,000). Thirty-seven of the State's 56 counties reported production.

The apparent rise in commercial sand and gravel production (1,272,000 tons) can be attributed entirely to better statistical coverage of the active operators, as a result of the 1953 canvass, and also to the excellent cooperation of the industry. Most of the increase in Government-and-contractor production—5,865,000 tons—was due to initiation of construction at the Tiber Dam site in Liberty County by the Bureau of Reclamation (4,388,000 tons) and to expanded activities of the Montana State Highway Department (increase of 1,222,000 tons).

Stone.—The total production of 1,320,000 tons of stone valued at $1,385,000 was divided between commercial, 1,264,000 tons ($1,349,000), and Government-and-contractor, 56,000 tons ($36,000). Production was reported from 14 counties in the State; basalt, granite, limestone, and sandstone were mined. Production figures in 1954 include limestone used in manufacturing cement and lime.

Talc.—Output and shipments of talc declined about 16 percent from 1953. Tri-State Minerals Co. continued to operate the Treasure State and Smith-Dillon mines near Dillon in the Beaverhead-Madison County area. Talc from these mines was shipped to the company grinding plant in Utah for ultimate use in ceramics and paint. Sierra Talc & Clay Co. shipped the output of its underground Yellowstone mine near Ennis, Madison County, to its grinding plant in Grand Island, Nebr.

Initial production was recorded by Nonmetallics, Inc., Helena, at open-pit and underground mines near Alder, Madison County. The product was shipped to American Chemet Corp., East Helena, for grinding.

Vermiculite.—Montana maintained its position as the principal vermiculite-producing State owing to output by the Zonolite Co. at its open-pit mine 7 miles northeast of Libby, Lincoln County. Screened and cleaned vermiculite was produced at about the 1953 rate. The Zonolite Co. also produced and marketed an exfoliated product.

Western Mining Corp. of Boise, Idaho, reportedly purchased vermiculite deposits near Bozeman, Gallatin County, and planned to build an exfoliation plant at Nampa, Idaho.

Robinson Insulation Co., Great Falls, Cascade County, purchased, exfoliated, and marketed vermiculite.

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TABLE 13.—Sand and gravel sold or used by producers, 1953–54, by classes of operations and uses

	1953			1954			Percent of change in—	
	Short tons	Value		Short tons	Value		Tonnage	Average value
		Total	Average		Total	Average		
COMMERCIAL OPERATIONS								
Sand:								
Building	191,254	$353,026	$1.85	306,873	$554,699	$1.81	+60	−2
Road material	37,385	37,354	1.00	30,067	27,629	.92	−20	−7
Other	26,878	4,864	.18	266,609	139,896	.52	+892	+189
Total commercial sand	255,517	395,244	1.55	603,549	722,224	1.20	+136	−23
Gravel:								
Building	203,578	273,869	1.35	467,857	636,984	1.36	+130	+01
Road material	61,769	68,062	1.10	832,731	793,909	.95	+1,248	−14
Railroad ballast	390,073	194,302	.50	351,246	269,533	.77	−10	+54
Other	268,645	114,493	.43	195,941	87,997	.45	−27	+13
Total commercial gravel	924,065	650,726	.70	1,847,775	1,788,423	.97	+100	+39
Total commercial sand and gravel	1,179,582	1,045,970	.89	2,451,324	2,510,647	1.02	+108	+15
GOVERNMENT-AND-CONTRACTOR OPERATIONS								
Sand:								
Building	5,966	15,359	2.57	31,090	46,582	1.50	+421	−42
Road material	312,321	44,200	.14	127,482	24,684	.19	−59	+36
Total Government-and-contractor sand	318,287	59,559	.19	158,572	71,266	.45	−50	+137
Gravel:								
Building	19,308	31,799	1.65	4,380,213	1,481,352	.34	[1]+22,586	−79
Road material	4,686,303	1,856,247	.40	6,350,435	3,396,995	.53	+36	+33
Total Government-and-contractor gravel	4,705,611	1,888,046	.40	10,730,648	4,878,347	.45	+128	+13
Total Government-and-contractor sand and gravel	5,023,898	1,947,605	.39	10,889,220	4,949,613	.45	+117	+15
ALL OPERATIONS								
Sand:								
Building	197,220	368,385	1.87	337,963	601,281	1.78	+71	−5
Road material	349,706	81,554	.23	157,549	52,313	.33	−55	+43
Other	26,878	4,864	.18	266,609	139,896	.52	+892	+189
Total sand	573,804	454,803	.79	762,121	793,490	1.04	+33	+32
Gravel:								
Building	222,886	305,668	1.37	4,848,070	2,118,336	.44	+75	−68
Road material	4,748,072	1,924,309	.41	7,183,166	4,190,904	.58	+51	+35
Railroad ballast	390,073	194,302	.50	351,246	269,533	.77	−10	+54
Other	268,645	114,493	.43	195,941	87,997	.45	−27	+5
Total gravel	5,629,676	2,538,772	.45	12,578,423	6,666,770	.53	+123	+18
Total all sand and gravel	6,203,480	2,993,575	.48	13,340,544	7,460,260	.56	+115	+17

[1] Material used in construction of Tiber Dam caused the large increase in tonnage of Government-and-contractor building gravel.

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MINERAL FUELS

Coal.—There was a decrease of about 20 percent in output and 15 percent in value of bituminous coal compared with 1953. The decline was due largely to reduced production at the Colstrip operation of Foley Bros., Inc., in Rosebud County. Sixteen counties (26 mines) reported output; the most important were Rosebud and Musselshell.

On September 3 a fire destroyed the tipple and preparation plant of the Roundup Mining Co. Late in the year the State ordered the Montana, Wyoming & Southern Railway Co. to resume operations out of Bearcreek. Prospects for increased mining activity in the Red Lodge area appeared favorable as a result of this action.

Petroleum and Natural Gas.—Crude-oil production increased from 11.9 million barrels valued at $26 million in 1953 to 14.2 million barrels worth $31 million in 1954. Initial commercial production was reported from five new fields: Cadmus and Landslide Butte, Glacier County; Fertile Prairie and East Little Beaver, Fallon County; and Wibaux, Wibaux County. Of the 337 new wells drilled during the year, 150 were oil, 30 were gas, and 157 were dry. Poplar field in Roosevelt County, the major producer in the State, yielded 3 million barrels. Other fields producing over 1 million barrels were Cut Bank, Glacier and Toole Counties; Elk Basin, Carbon County; and Kevin-Sunburst, Toole County. An account of exploration in the Williston Basin was published by the Bureau of Mines.[5]

The 10 refineries in the State processed an average of 24,752 barrels per day of Montana crude oil.

Natural-gas withdrawals increased about 8 percent over 1953. The Cut Bank field (including Reagan) in Glacier and Toole Counties was the most important producer.

REVIEW BY COUNTIES AND DISTRICTS

Beaverhead.—Manganiferous ore (10–35 percent Mn) totaling 237 long dry tons valued at $5,728 was shipped from 6 mines to the Government Stockpile depot at Butte. The largest output came from the Lulu Belle mine, operated by Ed Hughes. Other manganese-producing mines included the Iron Mask (Culver Hughes), Alice (Nellie Hughes), Blackstone No. 1 and No. 2 (W. H. Olsen), Shaffer (Olive K. Quick), and H. & S (Henry Shaffer). Minerals Engineering Co., the State's only large producer of tungsten ore and a leading domestic producer, operated the Ivanhoe and Lost Creek mines throughout the year. Ore was trucked 6 miles from the open-pit mines to the company mill near Glen. A crew of 20 men was employed at the Ivanhoe mine, and output averaged over 500 tons per day. The ore body was reported to be about 60 feet thick, with a proved strike length of about 1,000 feet. Preliminary exploratory work was begun with DMEA assistance in 1951 by American Alloy Metals, Inc. Minerals Engineering Co. took over operation of the mine in 1953 under a profit-sharing agreement and in 1954 acquired ownership of the property. Output from the company Lost Creek mine in the same area was limited owing to the lower grade of the ore.

[5] Lindsey, K. B. Petroleum in the Williston Basin, Including Parts of Montana, North and South Dakota, and Canada, as of July 1953. Bureau of Mines Rept. of Investigations 5055, 1954, 70 pp.

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(See also Tungsten.) A quantity of tungsten ore produced from the Grif Williams Birch Creek property was treated at the Minerals Engineering Co. mill.

Victor Chemical Works produced phosphate rock from the Canyon Creek mine near Melrose and mined quartzite for furnace flux in the same locality. Talc from the Smith-Dillon mine of Tri-State Minerals Co. near Dillon was shipped to Ogden, Utah, for grinding. (See Silver Bow and Madison Counties, respectively, for further activities of these companies.)

TABLE 14.—Value of mineral production in Montana, by counties, 1953–54

County	1953	1954	Minerals produced in 1954, in order of value
Beaverhead	$434,050	$2,853,170	Tungsten, lead, phosphate rock, talc, stone, silver, gold, zinc, copper.
Big Horn	96,074	219,009	Petroleum, sand and gravel.
Blaine	1,353,096	1,066,679	Petroleum, coal, sand and gravel.
Broadwater	129,762	194,832	Gold, lead, iron ore, silver, sand and gravel, zinc, copper, stone.
Carbon	4,594,629	4,685,085	Petroleum, stone, coal, sand and gravel.
Cascade	275,627	321,558	Sand and gravel, coal, clays.
Chouteau	3,550	(1)	Sand and gravel.
Custer	41,818	46,688	Coal, sand and gravel.
Dawson and McCone	[2] 2,111,707	[2] 2,427,508	Petroleum, sand and gravel, coal.
Deer Lodge	330,341	749,786	Pyrites, lime, stone, sand and gravel, tungsten, gold, clays, silver.
Fallon	245,611	616,873	Petroleum, sand and gravel, pumice.
Flathead	155,038	319,404	Stone, sand and gravel, silver, gold.
Garfield and Petroleum	[2] 556,843	[2] 539,058	Petroleum, sand and gravel.
Glacier, Liberty and Toole	[2] 12,114,681	[2] 12,988,220	Petroleum, sand and gravel, stone.
Granite	1,781,000	2,021,468	Manganese, silver, zinc, lead, stone, gold, copper, tungsten.
Hill	62,044	80,809	Sand and gravel, coal, clays.
Jefferson	397,294	358,190	Lead, stone, silver, zinc, gold, copper, sand and gravel.
Judith Basin	5,976	(1)	Lead, silver, zinc, gold.
Lewis and Clark	1,045,739	1,683,509	Zinc, sand and gravel, stone, lead, copper, gold, silver.
Mineral	180,325	87,085	Sand and gravel, lead, silver, copper, zinc, gold.
Missoula	306,261	281,087	Barite, sand and gravel, gold, stone, lead, silver.
Musselshell	2,428,622	2,344,039	Coal, petroleum, stone.
Park	169,307	281,584	Stone, sand and gravel, lead, silver, zinc, gold.
Phillips	159,183	(1)	Sand and gravel, gold, silver.
Pondera and Teton	[2] 1,724,822	[2] 1,441,464	Petroleum, sand and gravel.
Powell	2,350,331	2,771,246	Phosphate rock, lime, lead, stone, sand and gravel, clays, gold, silver, zinc.
Richland	80,672	177,727	Petroleum, coal, sand and gravel.
Roosevelt	1,861,804	5,785,601	Petroleum.
Rosebud	3,700,502	3,714,789	Coal, petroleum.
Sanders	438,979	565,778	Lead, sand and gravel, zinc, silver, copper, gold.
Sheridan	41,401	59,030	Coal, sand and gravel.
Silver Bow	82,035,158	58,901,159	Copper, zinc, silver, manganese, lead, phosphate rock, gold, sand and gravel, stone.
Stillwater	872,869	(1)	Chromite, sand and gravel, petroleum.
Treasure	1,556	(1)	Sand and gravel.
Valley	10,730	(1)	Do.
Wibaux	400,310	837,663	Petroleum.
Yellowstone	330,262	681,253	Sand and gravel, petroleum, clays.
Undistributed [3]	9,356,466	17,177,174	
Total	132,184,000	126,279,000	

[1] Included with "Undistributed" to avoid disclosure of individual output.

[2] Dawson and McCone, Garfield and Petroleum, Glacier, Liberty, and Toole, and Pondera and Teton Counties are combined because of joint oil-field production.

[3] Includes value of gem stones, natural gas, natural-gas liquids, stone, sand and gravel, and tungsten that cannot be assigned to specific counties. Also includes value of mineral production from the following counties: Fergus (gypsum, clay, sand and gravel, gold, silver), Gallatin (cement, stone, sand and gravel, lead, mica, silver), Lincoln (vermiculite, sand and gravel), Madison (talc, gold, lead, tungsten, zinc, silver), Meagher (lead, zinc, silver, gold), Prairie (1954) (sand and gravel), Ravalli (fluorspar, sand and gravel, gold, silver), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 1).

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Argenta District.—Active properties in the district were the Ferdinand and Tuscarora (Rudy Nygren), Ferdinand (mill cleanup—M. D. Jordan), Goldfinch (H. C. Russell), Goldsmith (R. H. & G. M. Fleming), Goodview (Oral P. Cummings), Hand (formerly Maulden or Louis Philipe mine—Ida B. Hand), Mohawk (John Ward), Silver Horn (Paul Bortch), Sylvia (G. Thompson, W. K. Jones, and W. C. Wallace), and Yellow Band (Carl Shafer and Harry Renz). Except for the Mohawk and Yellow Bank, which produced gold-silver ore, each of the operations listed produced lead ore. The largest production was from the Hand mine which yielded 2,744 tons of ore containing (in terms of recoverable metal) 54 ounces of gold, 7,100 ounces of silver, 21,600 pounds of copper, 721,600 pounds of lead, and 108,000 pounds zinc.

Blue Wing District.—Eighty-seven tons of lead ore containing values in gold, silver, copper, and lead was shipped from the Charter Oak mine by F. E. Herr.

Bryant District.—Gold-silver ore having values in copper, lead, and zinc was shipped from the Hecla mine by Lively Mining Co. (L. B. Lively, lessee).

Chinatown District.—Two operators (Ed Hughes, and Reed Stewart and Harry Shafer) produced 29 tons of lead ore from the H & S mine. R. A. Wilborn produced a small quantity of lead ore containing some recoverable zinc and silver from the Templeton mine.

Big Horn.—An increase of 58,392 barrels of crude oil was recorded from the Ash Creek, Hardin, and Soap Creek fields. Total value was $114,332. Natural gas also was recovered. The county highway department produced gravel for use on roads.

Blaine.—The Bowes field produced 980,414 barrels of crude oil valued at more than $1 million. The field also was an important source of natural gas. The Milk River coal mine near Chinook was operated throughout 1954 by G. S. and L. W. Sargent. Output of pit-run gravel for use in roads was reported by the county highway department.

Broadwater.—Ralls & Harris Bros. produced iron ore for use in cement manufacturing from the Iron Cross open-pit mine near Radersburg.

Gravel for railroad ballast and limestone for riprap were mined by the Chicago, Milwaukee, St. Paul & Pacific Railroad Co.

Backer District.—Small quantities of gold and silver were recovered from stream gravel by U. L. and H. L. Paston at their Confederate Gulch claim and by amalgamation of gold ore from the Old Miller property by Beavertail Mining Corp.

Beaver District.—About 800 tons of lead ore containing 525 ounces of gold, 18,079 ounces of silver, 5,100 pounds of copper, 300,900 pounds of lead, and 52,500 pounds of zinc (recoverable metal figures) was produced by Ed Pohl from the January mine. Other active properties included the Edna (gold ore—Reynolds & Berndt), Edna No. 2 (gold ore—William Zimmerman), Little Bonanza (lead ore—Anderson & Wagner), Martha W. (gold ore—R. A. Tomcheck), and Silver Saddle (lead ore—Harold Hagan).

Cedar Plains District.—A small quantity of gold-silver ore was produced from the Gold Bug property by T. E. Carpentier.

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Park or Indian Creek District.—Shipment of 500 tons of gold ore with a recoverable content of 935 ounces of gold, 3,183 ounces of silver, 600 pounds of copper; 17,400 pounds of lead, and 13,200 pounds of zinc was reported by Al Dance from the Marietta mine. Small production also was reported for the Phoenix mine (lead ore—Belder & Fuller), Pioneer mine (lead ore—Bill Lowery), and the Silver Wave mine (lead dump ore and gold-silver dump ore—Kenneth Toney and C. W. Swagerty).

Carbon.—The Elk Basin field produced over 1.5 million barrels of crude oil. The total value for the county was almost $4.5 million. Contributing fields, in addition to Elk Basin, were Clarks Fork, Dry Creek, Frannie, Golden Dome, and Jack Creek. Appreciable quantities of natural gas also were produced. Peter Kiewit Sons' Co. produced crushed limestone at the Warren quarry for use at sugar refineries. Most of the coal production from the Red Lodge field came from the Brophy No. 4 (Smokeless and Sootless) mine of Brophy Coal Co. and the Smith mine of Montana Coal & Iron Co., which was operated under lease by Smith Mine Coal Dock, a partnership. Production of coal from the county dropped sharply after rail service from Bearcreek to Red Lodge was discontinued by the Montana, Wyoming & Southern Railway Co. in mid-1953; however, it was announced late in 1954 that this service was to be resumed. The Northern Pacific Railway mined gravel near Edgar for railroad ballast. Tony Ram operated a commercial sand and gravel plant near Red Lodge.

Cascade.—Operations at The Anaconda Co. electrolytic zinc, electrolytic copper, and ferromanganese plants at Great Falls were shut down for nearly 2 months by the International Union of Mine, Mill, and Smelter Workers strike that affected all company activities in Montana. An expansion program designed to meet demands for future requirements for wire and cable used in the electrical industry was carried on at Great Falls by the Anaconda Wire & Cable Co.

County highway crews, the Great Northern Railway Co., and commercial producers mined sand and gravel. Coal production was recorded from the East Belt and Surmi mines. Clay was mined at the Armington property and used in manufacturing refractories at the Anaconda metallurgical works, Deer Lodge County. The Great Falls Brick Co. produced clay for structural clay products at the Gianinni pit 13 miles south of Great Falls. Montana Concrete Pipe Co., Great Falls, added facilities for making standard-size concrete bricks. Vermiculite purchased from Zonolite Co., Libby, was expanded and marketed by Robinson Insulation Co., Great Falls, for use as home insulation, plaster aggregate, and concrete aggregate.

Chouteau.—The county highway department produced paving and road gravel.

Custer.—Sand and gravel was mined by county highway and railroad crews. T. J. Fleming produced lignite from the Storm King mine, 12 miles east of Miles City. The deposits of coal in Custer and Powder River Counties suitable for stripping were described.[6]

Dawson and McCone.—These counties are considered together because the Richey oil field extends across the Dawson-McCone

[6] Brown, Andrew, and others, Strippable Coal in Custer and Powder River Counties, Mont.: Geol Survey Bull. 995-E, 1954, 199 pp.

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County line. Production from this field, the first commercial discovery in eastern Montana, continued to increase. The Deer Creek and Glendive fields in Dawson County and the Southwest Richey field in McCone County also made important contributions to the area total of 1,208,654 barrels valued at $2,379,186. Smaller production was reported from the Sand Creek, Woodrow, and Yellowstone fields. Three sand and gravel operations were active near Glendive, Dawson County. The Northern Pacific Railway Co. produced gravel for ballast and fill near Glendive. A small tonnage of lignite was mined in the two counties.

Deer Lodge.—According to The Anaconda Co. annual report for 1954, the improvement and expansion program in 1952 and 1953 at the company ore-processing plant at Anaconda was virtually completed during the year (see Montana chapter, Minerals Yearbook, vol. III, 1952 and 1953). A new crushing plant and a conveyor to the concentrator bins were to be completed in the first half of 1955. The plant was shut down by the general strike of the International Union of Mine, Mill and Smelter Workers from August 23 to October 18; advantage was taken of the down time to make major repairs and clean out flues. A substantial quantity of tungsten ore was mined from the Tip Top property by J. W. Abbott and milled by Henderson Tungsten Co. Other tungsten producers reporting small shipments of ore were B. H. & M. Tungsten Co. (New Year claim), Canyon Lode Mining Co. (Cable), Carl Coan (Ophir), 4-Some Mining Co., McLane & Henderson (Lucky Arrowhead), Moe & Heaphy (Olson Mountain), Silver Hill Tungsten Mining Co. (Silver Lake), Marvin Smith (Oldson), and Sunshine Mining Co. (Storm Lake). Sunshine Mining Co. deepened the 100-foot shaft at the Storm Lake mine by 100 feet and did about 500 feet of exploratory drifting and some diamond drilling.

Raw materials employed at the Anaconda Reduction Works included pyrite recovered from Silver Bow County base-metal mill tailings at Anaconda for use in making the sulfuric acid consumed at the phosphate plant; limestone (from Brown's quarry), which was burned to quicklime and used in various plant operations; phosphate rock received from company-owned mines at Conda, Idaho, and utilized in the manufacture of treble superphospate and phosphoric acid; and clay obtained from the Harold Snow operation near Anaconda and the Armington mine in Cascade County for use at the reduction-works brick plant. Two firms in the county prepared sand and gravel for concrete aggregate.

Georgetown District.—H. H. Hoben recovered gold and some silver by amalgamation at the Gold Coin mine. Robert H. Montgomery shipped a small quantity of silver ore to the East Helena smelter from the Silver Reef mine.

Fallon.—Crude-oil production totaled 308,871 barrels valued at $578,731. Two new fields—Fertile Prairie and East Little Beaver—as well as the Cabin Creek and Little Beaver fields contributed. Natural gas was recovered from the Cedar Creek field. Pumice and sand and gravel produced and prepared by the Baker Cement Products Co. near Baker were used in concrete aggregate for making cement blocks.

Fergus.—The Ideal Cement Co. produced gypsum at the company-owned Hanover mine near Trident for use as a retarder in cement

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manufacture and for agricultural purposes. The Shoemaker mine and Heath plant of United States Gypsum Co. were active throughout the year. Ground raw gypsum, wall board, and rock lath were produced at the Heath plant. At Lewistown the Lewistown Brick & Tile Co. produced heavy clay products from locally mined clay. The Chicago, Milwaukee, St. Paul & Pacific Railroad Co. produced gravel for ballast.

Warm Springs District.—Gold ore containing some silver was shipped from the Maginnis mine by H. Weiglenda.

Flathead.—Construction work on the Anaconda Aluminum Co. $50 million plant near Columbia Falls continued throughout the year, except for a 10-week period in the spring when work was halted by a carpenters' strike. Work at the plant site was begun in 1952, and initial production was expected by mid-1955. Construction employment at the plant was reported to exceed 1,100 workers during the summer.

Three firms at Kalispell and one at Columbia Falls produced sand and gravel for concrete. The Great Northern Railway Co. mined sandstone and gravel in the county.

Hog Heaven District.—Forty-nine tons of gold-silver ore was shipped to the East Helena smelter from the O. F. Martin property by M. & J. Mining Co.

Gallatin.—The principal mineral industry in the county was the Ideal Cement Co., Three Forks Portland Cement Division, plant at Trident. Limestone used in the manufacturing process was mined near the plant. Vermiculite deposits near Bozeman reportedly were purchased by the Western Mining Corp., Boise, Idaho. Plans also were announced to build an exfoliation plant at Nampa, Idaho. Gallatin County crews quarried stone for riprap and sand and gravel for roads. Four operators produced sand and gravel in the Bozeman area. Mica produced by Daniel T. Barham was purchased by GSA.

Deer Park District.—Hokanson Bros. shipped lead ore from the Deer Park property.

Garfield and Petroleum.—The Cat Creek oilfield is on the Garfield-Petroleum County line. Production from this field, the third oil discovery in the State, declined to 200,453 barrels. The Rattlesnake Butte field, which recorded its initial output in 1953, did not produce. Pit-run gravel for roads was produced in Petroleum County.

Glacier, Liberty, and Toole.—These counties are considered together because some of the petroleum-producing fields extend across county lines. The total area yield of 4,206,157 barrels valued at $11,445,160 was 242,452 barrels less than 1953. The Cut Bank and Kevin-Sunburst fields, second-and fourth-ranking in the State, accounted for about 90 percent of the area total. Initial production was recorded from the Cadmus and Landslide Butte fields in Glacier County. No crude-oil production was reported from the Utopia field in Liberty County. The Cut Bank field was the leading natural-gas producer in the State. About 4.4 million short tons of gravel was produced by a contractor for embankment construction at the Bureau of Reclamation Tiber Dam project south of Chester. Processed sand and gravel for concrete construction and stone for riprap were produced at the project also. Shelby Sand & Gravel Co. operated a dredge and screening, washing, and crushing plant at Shelby.

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Granite.—Shipments of manganese ore from eight properties to the Government Stockpile at Butte and Philipsburg totaled over 35,000 short tons valued at more than $800,000. This output is not included in State mineral-production totals until removed from the stockpiles for commercial use. Producing properties were the Contact (Peter Antonioli), White Horse (Leonard Holmes), Guy Kneale (Guy Kneale), Climax (William McLean), Marie (Byron and Melvin Sanderson), True Fissure (Moorlight Group-Taylor-Knapp Co.), Trout-Algonquin (Trout Mining Division, American Machine & Metals, Inc.), and Comanche (James Young). Shipments to industry and to high-grade stockpiles (included in State totals) were made by Trout Mining Division. (See Flint Creek District.) A small quantity of tungsten ore was produced and milled by Henderson Tungsten Co. from the Henderson Creek property. Tungsten ore mined and treated by Philipsburg Tungsten Co. in 1953 from the Black Pine mine was shipped to Mineral Recovery & Engineering Co. at Osburn, Idaho, for upgrading. Carl Schreiner (Solar Corp.) also produced a small quantity of tungsten ore.

Limestone for use at sugar refineries was produced during the year.

Alps District.—Alps Mining & Milling Co. milled a quantity of gold ore from the Argo mine and shipped the concentrate to the East Helena smelter.

Boulder and South Boulder District.—Lead ore containing recoverable silver and zinc was shipped from the Princeton mine by Charles Anderson.

First Chance District.—A quantity of gold and some silver were recovered by dragline dredging of stream gravels by George Brys from the Bearmouth placer property.

Flint Creek District.—The Trout Mining Division, American Machine & Metals, Inc., operation at the Trout-Algonquin property continued to be the largest in the county. Output of battery-grade oxide-manganese ore ranked the mine as a leading domestic producer of this strategic commodity. Shipments were made to the National Strategic Stockpile and to industry. A substantial quantity of lower grade (10–35 percent Mn) material was sold to industry and shipments also were made to the Government Low-Grade Stockpile Depot at Butte. The company milled 23,531 tons of lead-zinc ore, yielding 399 tons of lead concentrate and 2,063 tons of zinc concentrate, and also shipped lead-zinc ore for direct smelting. The company ore and concentrate also contained recoverable gold, silver, and copper. Zinc ore containing recoverable gold, silver, copper, and lead was milled at the Scratch Awl mine by Peter Antonioli and at the True Fissure mine by Taylor-Knapp Co. Taylor-Knapp Co. undertook a large-scale exploration program with DMEA assistance. Earlier exploration of the 600 level of the True Fissure mine revealed manganese carbonate mineralization to an extent warranting further work at deeper levels. Dewatering of the 1,000-foot shaft to the 900 level was planned. Battery-grade manganese ore was produced from the upper levels of the mine until exhaustion of the overlying oxide zone in 1952. The primary manganese carbonate deposits in the lower portion of the mine reportedly ranged from 8–28 percent manganese and averaged about 18 percent manganese. Ore from the mine was upgraded to about 30 percent manganese by magnetic concentration

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in the company mill before shipment to the National Strategic Stockpile. Gold ore containing some silver was shipped from the Dandy claim by G. W. Robertson.

Hill.—Havre Sand & Gravel produced washed sand and gravel for building purposes and pit-run gravel for fill. The Rocky Boy coal mine was operated part of the year by Alfred Laursen. A small tonnage of clay was mined by Frank Thompson, and a minor quantity of natural gas was recovered from the Box Elder field.

Jefferson.—Manganese ore was shipped to the National Strategic Stockpile at Butte by Curtis Hughes from the Horsefly mine. Uranium ore was shipped to a processing plant in Utah from the Lone Eagle mine by A. H. Eiselein & Associates.

Limestone was produced by the Maronick Limestone Co. for use at the East Helena lead smelter of American Smelting & Refining Co. The Great Northern Railway Co. mined gravel for ballast.

Boulder District.—A small quantity of lead ore was shipped from the Bernice mine by A. B. Madden.

Cataract (Basin) District.—The Aurora (lead ore), Basin Jib (gold ore), Bonanza Jack (gold-silver ore), Hanna (lead ore), and Obelisk (silver ore) properties were operated by John Wall, Basin Jib Gold Mines, Inc., M. R. Massey, Edward Mackay, and Frank Soll, respectively. Basin Jib Gold Mines, Inc., open-pit-mined large blocks of silver-lead ore, left when the mine was operated formerly as an underground mine.

Clancy & Lump Gulch District.—Louis Peura shipped 2,289 tons of silver-bearing old tailing from the Little Nell dump to the East Helena smelter. The material contained values in copper, lead, and zinc, as well as silver. Shipments were also made from the Frohner (gold-silver), Good Friday (lead-zinc), and Nellie Grant (lead) properties by Ed Lahey and Woodrow Beaver (from the latter two properties).

Colorado District.—Gold-silver ore containing recoverable values in copper, lead, and zinc was shipped from the Alta mine by Lahey Leasing Co. Old slag from the Wickes smelter site was shipped to the East Helena smelter by Louis Peura. The slag contained recoverable gold, silver, copper, lead, and zinc.

Elkhorn District.—The New Elkhorn Queen, Inc., operation at the Elkhorn Queen mine produced 1,030 tons of lead ore containing values in gold, silver, copper, lead, and zinc.

Whitehall District.—The Perhaps and the South View mines, operated by Lester Lindquist and Charles O. Weber, respectively, yielded small quantities of ore containing gold, silver, lead, and zinc.

Judith Basin.—Exploratory drilling by Minnesota interests of an iron deposit southeast of Great Falls was reported.

Barker District.—Croff & Montague produced 307 tons of lead ore from the Tiger mine.

Yogo District.—A small quantity of recoverable silver, gold, and copper obtained from tailings from the old Blue mill site was shipped to the East Helena smelter by L. Van Wageman and Jim White.

Lewis and Clark.—Ores, concentrates, and residues from domestic and foreign operations were treated at the American Smelting & Refining Co. lead smelter at East Helena throughout the year, except for the period May 6–June 9 when the plant was shut down by a

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strike. The smelter's crew of over 200 men was affected by the brief shutdown. Slag from the lead smelter's furnaces was transferred to the adjacent zinc-fume plant of The Anaconda Co. for treatment to recover the zinc. The Anaconda plant processed 138,457 tons of molten slag from the lead smelter as well as 50,302 tons of old slag resulting from the early operations of the lead smelter. The zinc-fume plant produced 32,699 tons of fume, most of which was shipped to the Anaconda electrolytic zinc plant at Great Falls for conversion to slab zinc. Output from the East Helena fuming plant, which resulted from treatment of old slag, was credited to current mine production statistics.

The Helena Sand & Gravel Co. operated a sand, gravel, ready-mixed concrete, and asphaltic paving business at Helena. Western Clay Manufacturing Co. obtained clay from Bossburg, 16 miles west of Helena in Powell County, for use at its Helena clay-products plant. The Great Northern Railway Co. quarried and crushed granite for riprap.

Heddleston District.—Lead-zinc ore from the Consolation mine and copper-lead ore from the Mike Horse mine were produced by Earl Neece and Norman Rogers Mining Co., respectively.

Helena District.—Gold ore from the Franklin mine and Franklin dump was produced by A. L. Johnson and Starratt Burgess, respectively.

Lincoln District.—A small quantity of gold was recovered by amalgamation at the Discovery mine by Cy Clinger. Gold ore containing small quantities of gold and silver was shipped to East Helena by Jack Parks from the Gold Dollar mine.

Madison Gulch District.—A small quantity of gold was recovered by amalgamation at the Humdinger mine by Ray W. Crumb. Production was reported from the Big Ox mine (lead ore) by John W. Fulton and from the Marsha mine (lead-zinc ore) by Robert O'Connell, Jr. Two operators mined 986 tons of gold-silver ore, containing 449 ounces of gold, 5,796 ounces of silver, 600 pounds of copper, and 4,800 pounds of zinc, from the Drumlummon mine.

Rimini District.—Production was reported for the Kit Carson mine (silver ore—John Haller), Silver Crescent mine (lead-zinc ore—Silver Crescent Mining Co.), and Wisconsin mine (lead-zinc ore—George Sawallisch). Sale was reported of a small quantity of placer gold and silver produced in previous years from the Caesar Vercellin Black Eagle claim.

Scratch Gravel District.—A quantity of gold and silver was produced from gold ore at the Ajax mine by H. T. O'Reilly.

Smelter District.—The metals credited to the Smelter district came from old slag treated at the East Helena zinc-fuming plant of The Anaconda Co.

Lincoln.—Production of vermiculite by the Zonolite Co. from its open pit, 7 miles northeast of Libby, was greater than that of any other single operation in the United States. Completion of new processing facilities was to enable utilization of vast quantities of low-grade vermiculite-bearing rock. Libby Sand & Gravel mined gravel for concrete aggregate, and a contractor produced pit-run and processed gravel for the Great Northern Railway Co.

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Madison.—Tungsten ore mined and milled by Pony Tungsten Enterprise at the Strawberry property was shipped to Mineral Recovery & Engineering Co. in Shoshone County, Idaho. The company reportedly took out ore from two levels of the mine and converted an old gold stamp mill for use in recovering the scheelite.

Mining of talc was the only nonmetallic-mineral activity in Madison County. Nonmetallics, Inc., Helena, made its first shipment of talc from open-pit and underground mines near Alder. The talc was shipped to American Chemet Corp., East Helena, for grinding. Talc from the underground Yellowstone mine near Ennis (Sierra Talc & Clay Co.) and Treasure State mine near Dillon (Tri-State Minerals Co.) was shipped to company-owned grinding plants at Grand Island, Nebr., and Ogden, Utah, respectively.

Pony and South Boulder District.—Ten tons of gold ore containing 8 ounces of gold and 4 ounces of silver was mined and milled by Denzil and Basil Nicholson at the Ridgeway mine.

Rochester District.—Commonwealth Lead Mining Co. produced 27 tons of lead ore containing recoverable gold, silver, lead, and zinc from the Commonwealth (Calvin) mine. The mine was leased to Blaine Jensen. W. C. Geibel and J. H. Patterson produced gold ore from the Emma mine, and gold ore was produced from the Thistle mine by James P. Reed. Production from the latter two mines occurred before 1954.

Sheridan District.—A few ounces of gold and silver was produced at the Hunt Mining Co. placer operation.

Silver Star District.—The Edgerton mine (gold ore) and the Peterson mine (zinc ore) were operated by William Kornec and William Pruett, and Dean Peterson, respectively.

Tidal Wave District.—Two tons of gold ore containing 3 ounces of gold and 4 ounces of silver was produced by Lewis C. Rollins from the Black Ace mine and shipped to the East Helena smelter.

Washington (Meadow Creek) District.—A small gold and silver output was reported by John Caster at the Bald Mountain placer.

Meagher.—*Beaver (Thomas Creek) District.*—Small quantities of gold and silver from the Ralph Krause Prosperous placer claim and the Grant Schmid Groundhog placer were received by the Denver Mint.

Castle Mountain District.—Glenn Franklin produced lead ore from the Cumberland mine. The ore, which contained recoverable quantities of silver, lead, and zinc, was shipped to the East Helena smelter.

Mineral.—Sand and gravel was produced by the county highway department.

Cedar and Trout Creek District.—Vance Fallon and Vernon Sides operated the Silver Sunrise property and produced 60 tons of lead ore, from which 4 tons of lead concentrate containing 109 ounces of silver, 600 pounds of copper, 3,800 pounds of lead, and 400 pounds of zinc was recovered.

Keystone District.—At the Nancy Lee mine E. G. Smith, lessee, produced 1,591 tons of lead ore from which 142 tons of concentrate containing 17 ounces of gold, 8,175 ounces of silver, 8,100 pounds of copper, 168,800 pounds of lead, and 13,200 pounds of zinc was recovered.

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Missoula.—Mallow and Christman (lessees) shipped manganese ore to the National Strategic Stockpile at Butte from the Cook property.

Barite was produced near Greenough, 30 miles east of Missoula, by Finlen & Sheridan Mining Co. The principal market was for use in rotary-drilling mud. Three sand and gravel operators were active at Missoula. The Northern Pacific Railway Co. produced stock-car sand at McQuarrie, and the Chicago, Milwaukee, St. Paul, & Pacific Railroad Co. mined gravel and stone in the county for ballast. Lyon Construction Co. crushed stone for use as riprap.

Copper Cliff District.—Paul Page and George Mongar milled 35 tons of old tailing and produced 2 tons of lead ore at the Blacktail mine. The recoverable content of the material was 14 ounces of silver and 6,200 pounds of lead.

Nine Mile District.—William Lamon amalgamated a small quantity of gold ore from the Nine Mile mine. E. T. Vincent and Clay Lewis mined approximately 51,000 cubic yards of stream gravel by dragline dredging at the Josephine Creek property and recovered a considerable quantity of gold and some silver.

Musselshell.—The county ranked second in the State in coal production and first in number of active coal mines, with 10 mines producing over 1,000 tons each. The Klein No. 2 mine of Republic Coal Co., the Roundup No. 3 operation of the Roundup Mining Co., and the Mountain Queen mine, Mountain States Mining Co., were the leading producers. Production from the Roundup No. 3 mine was curtailed in the last quarter because of a fire that destroyed the tipple and preparation plant. Crude-oil production totaled 414,209 barrels valued at $799,343. Big Wall and Melstone were the major producing fields. Crushed sandstone for riprap was produced by the Chicago, Milwaukee, St. Paul & Pacific Railroad Co.

Park.—Lyons Construction Co. produced crushed stone for use as riprap and ballast by the Northern Pacific Railway Co. The county road department mined sand and gravel. A commercial sand and gravel plant was operated at Livingston by Eggar Bros.

New World District.—Lead ore was produced from the Hudson mine by Mus Bros. and from the Saint Jude (formerly Saint Elmo) mine by Raymond Mus.

Phillips.—The Bowdoin field, which extends into Valley County, was the second largest natural-gas producer in the State. Gravel for ballast and other uses was prepared near Cole by the Great Northern Railway Co.

Little Rockies District.—A small quantity of gold ore was produced from the Hawkeye mine by Northern Mining Co.

Pondera and Teton.—These counties are considered together because the Pondera crude-oil-producing field extends into both counties. The total crude-oil production from the counties was 551,329 barrels valued at $1,436,711. The Great Northern Railway Co. mined ballast gravel in Pondera County. John Richem operated a sand and gravel business at Choteau, Teton County.

Powder River.—The Geological Survey published a study of the undeveloped low-grade coal beds in Powder River and Custer Counties.[7]

[7] Work cited in footnote 6.

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Powell.—E. C. Ecklesdafer and Wm. H. Howell shipped manganese ore to the National Strategic Stockpile at Butte from the Pauly lease and the Deer Lodge mine, respectively.

Phosphate-rock mining near Garrison was the principal mineral industry of the county. Montana Phosphate Products Co., a subsidiary of Consolidated Mining & Smelting Co. of Canada, Ltd., operated the Anderson, Graveley, and Luke mines and shipped the output to chemical fertilizer plants at Trail and Kimberly, B. C. George Relyea operated the nearby Relyea mine. This production also was shipped to British Columbia. The Mastodon Sand & Gravel Co. was active at Deer Lodge, and the Chicago, Milwaukee, St. Paul & Pacific Railroad Co. produced gravel for ballast. Clay was mined at Blossberg by Western Clay Manufacturing Co. for use at its Helena structural clay-products plant.

Nigger Hill District.—Lead ore was produced from the Charter Oak mine by Charter Oak Mining Co., from the Hard Luck mine by Larry Ward, and from the Negros mine by John F. Hopkins. Lead-zinc ore from the Big Dick and Black Jack claims was produced by Golden Anchor Mining & Milling Co.

Pioneer District.—A few ounces of gold were recovered by drift mining by Elder Lucier at the Amended Drift property.

Ravalli.—S. A. Cummings, and H. E. Roberts, Compton, Calif., mined fluorite from the Crystal Mountain open-pit deposit 30 miles east of Darby. The bulk of the production was used at the Geneva, Utah, plant of United States Steel Corp. The county highway department mined gravel for roads.

Overwich District.—Output by Lurlee Smith of a few ounces of gold and silver from the Hughes Creek placer was reported.

Richland.—The crude-oil output of 75,444 barrels from the Brorson fields more than doubled the initial production of 1953. Small mines producing lignite were Jennison, Jennison Coal Co.; Thiel, Stanley and Charles Thiel; and Sidney, Merril Dunbar. Contractors produced a small quantity of paving gravel for the city of Sidney.

Roosevelt.—The Poplar oil field, discovered in 1952, became the fourth largest producer in 1953 and in 1954 surpassed all other fields in the State by almost 450,000 barrels. Total county production was 3,053,733 barrels valued at $5,785,601. Output was recorded from the Northwest Poplar field; but the Wolf Creek field, discovered in 1953, did not produce. A small quantity of natural gas was recovered in the Poplar area.

Rosebud.—Rosebud was the principal coal-producing county in Montana due to the output from Foley Bros., Inc., large open-pit mine at Colstrip. Output of coal was at a reduced rate compared with 1953. Production of crude oil from the Sumatra field continued to increase; its output of 732,669 barrels valued at $1,655,539 was 307,742 barrels greater than in 1953.

Sanders.—Gravel for road surfacing was produced by contractors for the Bureau of Public Roads.

Eagle District.—At the Jack Waite Mining Co. Jack Waite mine, operated by American Smelting & Refining Co. under a profit-sharing agreement, activity was maintained on a 6-day-week basis throughout the year, according to the company annual report. Production from the mine was 9,771 tons compared with 9,155 tons in 1953. The bulk

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of the mine output (9,151 tons) was milled and yielded 1,477 tons of lead concentrate (averaging 75.76 percent lead, 2.84 percent zinc, and 8.13 ounces of silver) and 820 tons of zinc concentrate (averaging 52.13 percent zinc, 2.84 percent lead, and 1.30 ounces of silver). Ore shipped direct to the East Helena smelter amounted to 620 tons assaying 75.43 percent lead, 4.65 percent zinc, and 6.20 ounces of silver. The mine is in an isolated area on the Idaho-Montana border northeast of Wallace, Idaho. Employment averaged about 22 men. A quantity of copper ore was shipped to the East Helena smelter from the Mascot mine by Roy Johnson.

Prospect Creek (Burns) District.—Lead-zinc ore milled at the Golconda mill near Wallace from the Montana Standard mine operated by Montana Standard Mining Co., Ltd., totaled 419 tons in 1954. Sixty-two tons of lead concentrate and 50 tons of zinc concentrate were produced at the mill and 8 tons of lead-zinc ore was shipped direct to the Bunker Hill smelter. The property, which was reopened by the company in the spring of 1953, has a history of production dating back to 1902.

Sheridan.—The Lagerquist and Acme lignite mines were operated part of the year. Gravel was mined for county roadwork.

Silver Bow.—As in previous years, the bulk of the gold, silver, copper, lead, zinc, and manganese ores produced in the county and in Montana in 1954 was derived from The Anaconda Co. Butte operations (see Summit Valley district). Manganese ore for shipment to the Government Low-Grade Stockpile at Butte was produced from 12 properties. The largest producers were the Nettie-Hubernic (Lloyd Brynie), Minee Jane (Butte Mines Merger Corp.), and Norwich-Plutus-Little Sara (I. G. Irving and R. H. Nelson). Other manganese producers were the Independent and Mapleton (Frank Antonioli), Tzarena (Peter Antonioli), Fredonia (Tony Bubany), Isele Lode (Butte Western Mining Co.), Chief Joseph (Hugh Handlin), Mapleton Lode (Roderick Kovick), Eagle Bird (Frank McNulty), and Marget Ann (Mitchell Mining Co.). The quantity of manganese ore shipped to the depot from these properties was more than 22,000 short tons valued at over $380,000. Mitchell Mining Co. ore was treated at a mill built during the year near Walkerville by Contract Milling Co.; ore from other properties also was milled on a custom basis.

Victor Chemical Works operated its Silver Bow elemental phosphorus plant throughout 1954. The factory began production in November 1951, and a second electric furnace was completed early in 1953. Phosphate rock was obtained from the company-operated Maiden Rock and Canyon Creek mines in Silver Bow and Beaverhead Counties, respectively. F & S Contracting Co. produced pit-run sand for mine fill and screened sand for construction in the Butte area, and Pioneer Concrete & Fuel, Inc., prepared building sand and gravel at Butte. A small quantity of granite was quarried for use as riprap by the Chicago, Milwaukee, St. Paul & Pacific Railroad Co.

Summit Valley District.—The output of copper ore from Butte mines by The Anaconda Co. totaled 3,736,319 tons, of which 9,484 tons was smelted directly. The output of copper concentrate from the remainder of the ore totaled 296,255 tons. The quantity of copper precipitate produced from mine water totaled 4,334 tons. According to The Anaconda Co. annual report for 1954, copper production from

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TABLE 15.—Production of gold, silver, copper, lead, and zinc in Silver Bow County, 1945–49 (average), 1950–54, and total 1882–1954, in terms of recoverable metals

Year	Mines producing	Material sold or treated (short tons)	Gold (lode and placer) (fine ounces)	Silver (lode and placer) (fine ounces)
1945–49 (average)	24	2,783,173	14,833	4,876,647
1950	21	3,387,270	23,163	6,128,549
1951	15	3,780,943	15,674	5,950,647
1952	21	4,425,605	16,930	5,518,197
1953	19	5,998,457	19,871	6,289,415
1954	22	4,987,849	17,395	4,663,439
1882–1954		(1)	2,173,942	591,318,578

Year	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1945–49 (average)	126,679,240	16,252,500	62,768,360	$37,792,150
1950	107,793,900	31,358,800	127,021,000	51,044,252
1951	113,652,000	33,260,000	161,000,000	68,492,990
1952	123,118,000	32,324,000	151,936,000	65,806,893
1953	155,040,000	33,534,000	150,340,000	72,566,257
1954	118,480,000	23,032,000	107,054,000	54,498,289
1882–1954	[2] 7,023,705	[2] 346,965	[2] 2,060,764	3,047,397,994

[1] Figure not available.
[2] Short tons.

the district was 25 percent less than in 1953 due mainly to the 2-month strike of the International Union of Mine, Mill, and Smelter Workers. Production of zinc from the company mines decreased only 8 percent; lead-zinc ore output totaled 1,191,927 tons, which included 282,645 tons of manganese ore containing recoverable lead and zinc. Concentrate production from this ore totaled 14,892 tons of lead concentrate, 103,221 tons of zinc concentrate, and 9,157 tons of silver-iron concentrate. The Skyrme mine, an open-pit operation on an easterly extension of one of the Kelley ore zones, began producing ore at the rate of approximately 2,000 tons per day during the latter part of the year. With regard to the Kelley block-caving operation inaugurated during the first half of 1952, the company annual report states that:

> During the year, development of the 1,300 level of the Kelley mine advanced sufficiently to permit ore mining from this level during the early part of 1955. Intermediate development of the 800 and 1100 Kelley mine levels proceeded on schedule in preparation for ore extraction to follow the removal of ore above the 600 level. Work on the auxiliary No. 2 Kelley mine shaft, surface construction of head frame, hoist building, and installation of the double drum 2,250-hp. electric hoist for this shaft were substantially completed at year-end.

Also, 46,550 feet of churn drilling was done during the year on an extensive near-surface, low-grade ore zone lying south and east of the main Kelley-mine ore areas as a part of a program seeking to establish the feasibility of increasing Butte copper production by large-scale, open-pit mining methods. The output of manganese ore from the Anaconda operations was off sharply from 1953. Competition from foreign ores and rising production costs necessitated closure of the Travona mine. Manganese ore and concentrate from Butte mines were shipped to the manganese concentrator and nodulizing plant at Anaconda. Nodules produced were shipped mainly to the company ferromanganese plants at Anaconda and Great Falls; quantities

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also were shipped to eastern steel plants and to the National Strategic Stockpile. Other active producers in the district were Norman Rogers (copper ore—Bertha, Bullwacker, and Rabbit mines), Frank Beniet (silver ore—E–2 and E–3 claims), Contract Milling Co. (silver ore—Florida claim), Dave Currie and A. G. Hooper (copper ore—Gem mine), Butte Western Mining Co. (gold-silver ore—Isele), Mitchell Mining Co. (gold-silver ore—Marget Ann mine), and Ted Farrow (copper ore—Sarsfield mine).

German Gulch District.—Linton & Roser Mining Co. processed 3,450 cubic yards of bench gravels at the Beal Dike property and recovered 70 ounces of gold and 10 ounces of silver.

Stillwater.—Chromium-concentrate production was continued throughout the year at the Mouat mine near Nye by American Chrome Co. Output, which began in 1953, was purchased by the Government. (See Chromium section of this chapter.)

Road gravel was produced by contractors for the county. The Lake Basin field produced 1,105 barrels of crude oil valued at $2,763.

Treasure.—The county road department produced sand and gravel for use on roads.

Valley.—Natural gas was recovered from the Bowdoin field, which extends into both Valley and Phillips Counties. Tampico Gravel Co. operated at Glasgow.

Wibaux.—Output of crude oil from the Pine Unit and newly opened Wibaux fields totaled 438,820 barrels valued at $837,663.

Yellowstone.—Four sand and gravel producers were active in the Billings area; the Great Northern Railway Co. produced gravel in the county; and the Bureau of Reclamation mined gravel for roads at the Huntley irrigation project. Crude-oil output from the Mosser field was 13,166 barrels valued at $21,836. Lovell Clay Products Co. manufactured heavy clay products at Billings.

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The Mineral Industry of Nebraska

By Frank J. Kelly [1] and Breck Parker [1]

DESPITE a decline in the production of some nonmetals, natural gas, and natural-gas liquids, the value of output of all minerals in Nebraska rose to a record total of $42.4 million in 1954, a 27-percent gain over 1953. Crude petroleum again dominated the mineral industry, accounting for 50 percent of the State mineral value in 1954, and shipments (as measured by pipeline sales) increased $4.2 million over 1953.

The Denver-Julesburg Basin in western Nebraska was the center of exploration and drilling in the State, and 99 percent of petroleum production came from 3 counties in this area. Cement continued to rank second among the State minerals, followed by sand and gravel, stone, natural gas, natural-gas liquids, clays, and pumicite. Gains in the value of output were reported for all mineral commodities except natural gas, natural-gas liquids, clays, and pumicite which showed small declines.

Some of the production data for 1954 were collected jointly with the Bureau of the Census, United States Department of Commerce. Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953, because of differences of coverage.

TABLE 1.—Mineral production in Nebraska, 1953–54, excluding uranium [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	175,856	$186,893	163,831	$163,831
Natural gas, million cubic feet	6,748	911,000	6,801	796,000
Petroleum (crude), thousand 42-gallon barrels	6,344	17,190,000	7,783	21,400,000
Sand and gravel	5,969,858	4,340,163	8,547,876	6,992,314
Stone	[2] 1,407,158	[2] 2,069,984	2,660,170	3,511,494
Undistributed: Cement, natural-gas liquids, and pumice and pumicite		[3] 8,582,904		10,637,123
Total		33,281,000		[4] 42,393,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes limestone for cement.
[3] Excludes value of clays used for cement.
[4] The total has been adjusted to eliminate duplication in the value of clays and stone.

[1] Commodity-industry analyst, Region III, Bureau of Mines, Denver, Colo.

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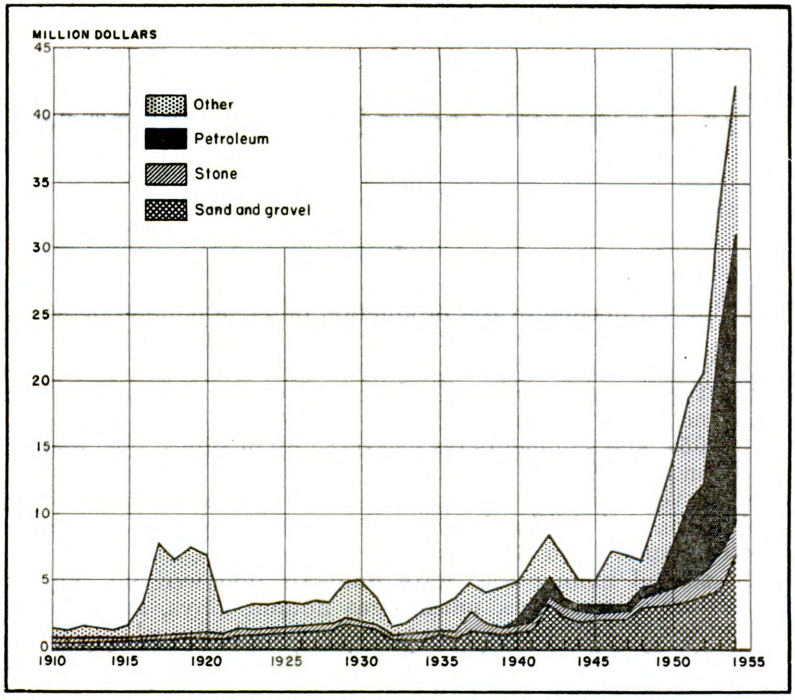

FIGURE 1.—Value of petroleum, sand and gravel, and total value of mineral production in Nebraska, 1910–54.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—The demand for cement in Nebraska continued to grow in 1954, and shipments, following the patterns of the general building boom in the Rocky Mountain area, increased 20 percent over 1953. The two cement plants at Louisville, Cass County, and Superior, Nuckolls County, operated throughout the year, producing types I and II portland cement, as well as masonry cement that, except for a small quantity, was shipped by railroad. Limestone and clay used in manufacturing the cement were mined locally and from nearby quarries in Kansas. Both plants used the wet process. In addition to the cement consumed in Nebraska, shipments of portland and masonry cement were made from the Nebraska plants to Iowa, Kansas, Missouri, and other adjoining States.

Clays.—Clay production continued at a record pace in 1954 owing to the steady demand for heavy clay products by the construction industry. Clays were mined by 6 brick companies from 9 open pits in 8 counties, as well as 1 open pit where clay used for the manufacture of cement was mined. A small quantity of stoneware clay was produced and used in manufacturing pottery in Cass County.

Perlite.—The Richlite Perlite Co. operated its expanded perlite plant at Omaha throughout 1954 on crude material from New Mexico.

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The bulk of the expanded output was consumed in making plaster; the residual was used in concrete aggregate.

Pumice and Pumicite.—Pumicite was produced from only one mine in Nebraska during 1954, and output increased slightly over 1953. The LaRue Axtell Pumice Co. operated an open pit in Custer County and a cleaning and sizing plant at Callaway. The processed pumicite was used for cleansing and scouring compounds and abrasives and as filtering material.

Sand and Gravel.—Sand and gravel mostly from alluvial deposits in the valleys of the Platte and Republican Rivers and their major tributaries, was produced in 61 Nebraska counties. Production of sand and gravel in 1954 was 43 percent greater, and the value of this production was 61 percent larger than in 1953. The significant gain was based partly on increased coverage of the statistical canvass, but primarily on a greater demand for sand and gravel by the construction industry. Nebraska, like other areas, felt the economic impact of the general upward trend in the building boom. The increased demand for sand and gravel can be noted in all major uses, as shown in table 2. Another factor that stimulated the industry was the increase in the average price paid for all sand and gravel, which rose from $0.73 per ton in 1953 to $0.82 in 1954. The 10 largest commercial sand and gravel producers during the year were: Christensen Gravel, Inc.; Einung Sand & Gravel Co.; Thomas & Gearhart, Inc.; H & M Equipment Co., Inc.; Lyman-Richey Sand & Gravel Corp.; J. W. McCann Co.; Paul Sawyer Sand & Gravel Co.; Schellberg Sand & Gravel Co.; R. M. Weblemoe; and Western Sand & Gravel Co.

Stone.—The accelerated highway-construction program in Nebraska and throughout the country was reflected in an 89-percent increase in the production of all stone during 1954. Crushed limestone constituted the largest single type of stone; a smaller quantity of crushed sandstone was produced. Of the total output, 52 percent was used as concrete aggregate for road use and riprap, and smaller quantities were consumed in manufacturing cement, as a mineral food, and in agriculture. Trucks transported 75 percent of crushed limestone; 20 percent was shipped by railroad and 5 percent by water. Dimension-limestone production consisted of rough construction, dressed and sawed stone, and rubble. The principal producers, listed in order of output, were: Stone Products Co., Cass County; Amis Construction Co., Cass County; Nelson Quarries, Inc., Nemaha County; and Kelly Bros. & Co., Douglas County.

Talc.—Ground talc, produced by the Sierra Talc & Clay Co. at its grinding plant at Grand Island, Hall County, from crude material received from California and Montana, was used in ceramics, paint, textiles, and toilet preparations.

Vermiculite.—The Omaha plant of Western Mineral Products Co. continued to operate during 1954 on crude material shipped in from Montana. The exfoliated vermiculite was used in loose-fill insulation, lightweight plaster, and concrete aggregate.

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TABLE 2.—Sand and gravel sold or used by producers, 1953–54, by classes of operations and uses

	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Molding	20,476	$27,857	$1.36	13,319	$8,744	$0.66
Building	923,944	661,949	.72	692,468	579,345	.84
Paving	747,397	533,948	.71	333,192	232,544	.70
Engine	106,648	69,286	.65			
Filter	(1)	(1)		1,242	2,484	2.00
Railroad ballast	(1)	(1)		10,050	4,229	.42
Other	39,500	15,625	.40	36,423	26,299	.72
Gravel:						
Building	938,932	710,947	.76	1,429,103	1,202,923	.84
Paving	2,734,073	2,078,800	.76	4,571,888	4,001,378	.88
Railroad ballast	(1)	(1)				
Other	7,447	4,725	.63	6,017	11,360	1.89
Undistributed	29,385	10,984	.37			
Total commercial sand and gravel	5,547,802	4,114,121	.74	7,093,702	6,069,316	.86
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building				5,000	3,750	.75
Paving	3,991	829	.21	351,720	171,880	.49
Gravel:						
Building	770	516	.67	3,446	1,763	.51
Paving	417,295	224,697	.54	1,094,008	745,605	.68
Total Government-and-contractor sand and gravel	422,056	226,042	.54	1,454,174	922,998	.63
Grand total	5,969,858	4,340,163	.73	8,547,876	6,992,314	.82

[1] Included with "Undistributed" to avoid disclosure of individual company operations.

MINERAL FUELS

Petroleum and Natural Gas.—Production of crude petroleum continued to increase substantially during 1954, as exploration and development in the western part of the State was intensified. The tricounty area of Banner, Kimball, and Cheyenne supplied 99 percent of Nebraska's crude. Natural-gas production, however, remained essentially at the 1953 level.

Since the 1949 Cheyenne County oil discovery, exploration efforts have steadily increased and have spread over a broader area. Better than 90 percent of 1954 wildcat and development wells were drilled in Banner, Cheyenne, and Kimball Counties, but wildcats were also completed in Box Butte, Buffalo, Cherry, Dawes, Garden, Grant, Harlan, Morrill, Perkins, Red Willow, Scotts Bluff, and Sioux Counties. Approximately 450 wildcat and development wells were completed in the western part of the State during 1954, with an aggregate footage of 2.5 million feet.

The most important results of the above efforts were the eastward extension of the Harrisburg field in Banner County, fuller development and extension of the Long field in Kimball County, new discoveries in northwestern Cheyenne County, and one successful wildcat in the southwestern Harlan County (No. 1 Houserman—sec. 1,

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T. 1 N., R. 17 W.—by Guy F. Atkinson Co., with an initial production of 25 barrels per day).

Leasing activity was low during the year, with no major rushes to acquire land reported.

Geophysical activity was dominated by seismic work, and 165 crew-weeks of effort was expended. Atlantic Refining Co., Ohio Oil Co., Continental Oil Co., and Skelly Oil Co., in order, were the major participants in seismic activity; work was concentrated in Scotts Bluff, Sioux, Cheyenne, Garden, Deuel, and Kimball Counties.

Factors that have stimulated exploration and production are low drilling costs ($4.00–$5.00 per foot), moderate depths (5,000–5,500 feet), availability of leases and farmouts, and ready outlets to markets. In addition to the major companies, many independent operators have found the area inviting owing to the low costs of testing ground and, if oil was discovered, the immediate market with resulting rapid return on investment.

Two pipeline developments that benefited the oil industry in western Nebraska were expansion of the Platte pipeline and the newly constructed Service pipeline, operated by Western Pipe Line Co. Both lines run from Wyoming through southwestern Nebraska and the prime producing counties of Banner, Cheyenne, and Kimball to eastern market distribution points.

Nebraska refinery capacity fell from 3,600 barrels per day at the beginning of the year to 3,000 barrels per day at year end with the shutdown of the Sioux Oil Co. skimming plant at Chadron, Dawes County. Crude for the Chadron plant came from eastern Wyoming fields. The Cooperative Refinery Association operated a skimming and cracking plant at Scotts Bluff on crude from eastern Wyoming and the Harrisburg field in Banner County, and Searle Petroleum Corp. operated at Salem in Richardson County.

Publications of the Oil and Gas Journal and Petroleum Information were utilized in preparing this section and are gratefully acknowledged.[2]

REVIEW BY COUNTIES

Of the 93 counties in Nebraska, 26 reported no production of any mineral commodities during 1954, 57 reported production of sand and gravel and/or stone only, and 12 reported output and sales of 2 or more mineral commodities.

Adams.—The Hastings Brick Plant of the Western Brick & Supply Co. produced building brick and tile for the Hastings area from miscellaneous clay mined nearby. Four men were employed at the clay pit for 250 days, and 22 men worked 43,000 man-hours at the brick plant. The production of commercial sand and gravel decreased sharply in 1954 compared with 1953 owing to lack of any significant road-construction activity.

Cass.—Cass County ranked as the most important county, in terms of values of output of the mineral industry. The total value of sales of mineral commodities reached $10.3 million in 1954, a 36-percent increase over 1953. Cement remained in first place in terms of value, followed by stone, sand and gravel, and clays.

[2] Oil and Gas Journal, Annual Review and Forecast Number: Vol. 53, No. 39, Jan. 31, 1955. Petroleum Information, 25th Annual Résumé of Rocky Mountain Oil and Gas Operations: 1954, p. 354.

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TABLE 3.—Value of mineral production in Nebraska, 1953–54, by counties [1] [2]

County	1953	1954	Minerals produced in 1954 in order of value
Adams	$53,876	$14,228	Sand and gravel, clays.
Antelope		18,600	Sand and gravel.
Banner	150	90	Do.
Boone	5,059	(3)	Do.
Boyd	5,182	6,723	Do.
Brown	(3)	55,361	Do.
Buffalo	40,550	243,388	Do.
Butler	41,486	20,550	Do.
Cass	7,588,253	10,344,301	Cement, stone, sand and gravel, clays.
Cedar	33,728	155,224	Sand and gravel.
Chase	(3)		
Clay	25,337	29,288	Sand and gravel.
Colfax		131,501	Do.
Cuming	82,946	(3)	Do.
Custer	(3)	(3)	Sand and gravel, pumice.
Dakota		42,629	Sand and gravel.
Dawes		800	Sand and gravel, clays.
Dawson	(3)	137,053	Sand and gravel.
Dixon		4,470	Do.
Dodge	515,636	884,430	Do.
Douglas	754,080	1,085,238	Sand and gravel, stone, clays.
Dundy	(3)	7,560	Sand and gravel.
Fillmore		91,134	Do.
Franklin		102,790	Sand and gravel, stone.
Furnas		63,425	Do.
Gage	73,644	(3)	Do.
Garden	9,356	725	Sand and gravel.
Greeley		2,720	Do.
Hall	160,586	193,684	Do.
Hamilton	4,760	3,950	Do.
Harlan	12,952	78,593	Sand and gravel, stone.
Hayes	17,060	(3)	Sand and gravel.
Hitchcock		26,318	Do.
Holt	10,700	50,277	Do.
Howard	(3)		
Jefferson	(3)	198,560	Sand and gravel, clays.
Keith	8,727	30,767	Sand and gravel.
Kimball		(3)	Do.
Knox	11,302	67,639	Do.
Lancaster	72,626	207,849	Clays.
Lincoln		73,300	Sand and gravel.
Loup	15,241	15,527	Do.
Madison	26,308	13,750	Do.
Merrick	(3)	148,326	Do.
Morrill	90,464	125,623	Do.
Nance		78,000	Do.
Nemaha	(3)	(3)	Stone.
Nuckolls	(3)	(3)	Cement, stone, sand and gravel, clays.
Otoe	289,975	10,010	Clays.
Pawnee		101,146	Stone.
Perkins	22,201	10,330	Sand and gravel.
Phelps	139,324	41,000	Do.
Pierce	(3)	89,272	Do.
Platte	232,320	246,300	Do.
Polk		14,000	Do.
Red Willow	(3)	62,889	Sand and gravel, stone.
Richardson	33,853	57,612	Do.
Saline	162,215	69,087	Sand and gravel.
Sarpy	675,445	741,905	Sand and gravel, stone.
Saunders	(3)	138,559	Sand and gravel.
Scotts Bluff	27,320	46,575	Do.
Seward		(3)	Stone.
Sioux	10,841	14,934	Sand and gravel.
Stanton	34,150	65,587	Do.
Thayer	24,627	171,194	Sand and gravel, stone.
Thomas	33	6,200	Sand and gravel.
Valley		23,373	Do.
Wayne	9,087		
Webster		670	Clays.
York	24,477	(3)	Sand and gravel.
Undistributed	21,934,567	26,835,728	
Total	33,281,000	[4] 42,393,000	

[1] The following countries are not listed because no production was reported: Arthur, Blaine, Box Butte, Burt, Cherry, Cheyenne, Deuel, Frontier, Garfield, Gosper, Grant, Hooker, Johnson, Kearney, Keya Paha, Logan, McPherson, Rock, Sheridan, Sherman, Thurston, Washington, Wheeler.

[2] Value of petroleum, natural gas, and natural-gas liquids included with "Undistributed;" data by county not available.

[3] Value included with "Undistributed."

[4] Total has been adjusted to eliminate duplication in the value of clays and stone.

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The production of types I and II portland cement continued to be the most important factor in the economy of the county. Total employment at the Louisville plant of the Ash Grove Lime & Portland Cement Co. averaged 210 men engaged in mining and cement-mill operations.

The stone industry in Cass County was stimulated by the general boom in construction. Production of crushed limestone both by commercial and Government-and-contractor producers was 2½ times greater in 1954 than in 1953. The bulk of the output was used for concrete aggregate and riprap in road construction. Significant quantities also were employed in manufacturing cement, as railroad ballast, and in agriculture. Sawed and dressed dimension limestone also was prepared from stone quarried locally by Waldo Stone Co.

The construction industry, pacing residential-and industrial-building demand, consumed 1 million tons of sand and gravel in 1954, 18 percent more than in 1953. Cass ranked first among those counties producing sand and gravel. Lyman-Richey Sand & Gravel Corp. and Western Sand & Gravel Co. were the major operators and produced structural sand and gravel as well as paving gravel.

The Kahler Pottery Co., Inc., more than doubled its output of stoneware clay used in manufacturing art pottery and flowerpots, and 2 men were employed in mining activities for a total of 60 days. The Ash Grove Lime & Portland Cement Co. quarried a large tonnage of shale for use in manufacturing cement. Both mines are near Louisville.

Custer.—Pumicite used in the production of cleansing and scouring compounds, abrasives, and filter mediums, showed a 5-percent increase in output in 1954 over 1953. The LaRue Axtell Pumice Co. employed 5 men in the operation of its pit and plant at Callaway.

Government-and-contractor production of sand and gravel for road use also was reported.

Dawes.—Hodkinson Bros., Chadron, operated a small brick plant using clay mined locally. In addition, A. L. Pace produced 1,500 tons of gravel used for structural purposes.

Dodge.—The upward trend in sales of sand and gravel in Dodge County followed the general State trend; an 8-percent increase was noted in 1954 over 1953, which established Dodge as the second largest sand-and-gravel-producing county. The output of paving sand and gravel continued to dominate sales, followed closely by structural material. Lyman-Richey Sand & Gravel Corp., Christensen Gravel, Inc., and Schellberg Sand & Gravel Co. were the major producers, in that order.

Douglas.—The sand and gravel industry remained as the largest single segment of the county mineral production in tonnage and value, as well as being the largest single employer. Lyman-Richey Sand & Gravel Corp., the major producer, operated three plants, followed by J. W. McCann Co., Hartford Sand & Gravel Co., and Acme Sand & Gravel Co.

Production of crushed and dimension limestone was also reported during the year. Kelly Bros. & Co. operated a quarry and crusher

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near Ralston and produced rubble, road metal, and limestone for agricultural purposes.

The production of miscellaneous clay for manufacturing building brick and heavy clay products showed a slight decline in 1954 as compared with 1953, but the Omaha Brick Works at Ralston operated throughout the year on newly mined clay and withdrawals from its stockpile.

Western Mineral Products Co. operated its Omaha exfoliated-vermiculite plant producing a product suitable for loose-fill insulation, lightweight plaster, and concrete aggregate, from crude material received from Montana.

Franklin.—Reports for the mineral industry of this county indicate the production of only sand and gravel and crushed sandstone. Amman Sand & Gravel Contractors, Bladen Sand & Gravel Co., and Olson Sand & Gravel Co. produced building sand and gravel as well as paving gravel, and four highway contractors produced crushed sandstone for use as riprap on highway projects.

Furnas.—Sand and gravel, crushed sandstone, and crushed limestone comprised the production of the mineral industry of Furnas County. Nearly all the output of these commodities was consumed in the construction and maintenance of county roads. A small quantity of building sand and gravel was produced to satisfy the demands of local building contractors.

Gage.—Paving gravel was produced by Johnson Bros. Sand & Gravel Co. and Wilson Bros. Sand & Gravel Co. from local pits. Grosshans & Petersen and Wymore Lime & Rock Co. produced crushed limestone for use as concrete road metal, railroad ballast, riprap, and for agricultural purposes. Output in 1954 showed a 9-percent gain over the 1953 total.

Hall.—Sand and gravel, chiefly for building and road construction, was produced by H. & M. Equipment Co., Inc., Bud Johnson Sand & Gravel, Riverside Sand & Gravel Co., and Western Brick & Supply Co.

Ground talc used in paint, textiles, and toilet preparations was produced at the Grand Island plant of the Sierra Talc & Clay Co. from crude material shipped in from California and Montana.

Harlan.—The production of gravel by the Olson Gravel Co., Huntley, and by contractors for the county highway department for use in the maintenance and construction of roads (the only segment of the mineral industry of the county reporting actively in recent years) was augmented in 1954 by the quarrying and crushing of sandstone for riprap. This material was produced in conjunction with a highway contract.

Jefferson.—For the first time in a number of years, a significant quantity of sand and gravel was sold in 1954 according to individual producer reports. Building and paving sand and gravel comprised the bulk of the sales, but railroad ballast and mortar sands were also reported.

The clay industry of the region also was active in 1954, but production of miscellaneous clay for manufacturing building brick and other heavy clay products remained at relatively the same level as that reported in 1953. Endicott Brick & Tile Co. employed 2 men in

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pit operations for 213 days, and 35 men worked 365 days at the brick plant. The Western Brick & Supply Co. also mined clay from the Fairbury Shale & Clay pit, where two men were employed for limited periods throughout the year.

Lancaster.—Limestone constituted the most important mineral commodity produced in the county. Crushed limestone used as road metal and for agriculture, as well as dimension stone for rough construction building stone, was produced by Schwarck Quarries, Inc.

The only other segment of the mineral industry reporting activity during the year was the Yankee Hill Brick Mfg. Co., where three men were employed in clay-mining operations for a total of 305 days. The company operated a brick plant at Lincoln for producing building brick and other heavy clay products.

Nuckolls.—The output of the mineral industry of the county showed a 28-percent increase in value over the 1953 total, and Nuckolls was the second highest ranking county, in terms of value.

The production and sales of types I and II portland cement and masonry cement by the Nebraska Division of Ideal Cement Co. at its plant at Superior were the major contribution to this total value. The plant, rated at 925,000 barrels per year, employed an average of 111 men in its crusher, cement mill, auxiliary works, and administrative operations. Shale, gypsum, and other raw materials were shipped in from other States, but limestone was quarried by the company from a pit nearby. A wet production process is used and 12,900,000 kilowatt-hours of electrical energy was consumed during the year.

Sand and gravel produced mainly by Federal and local governmental units and used in road construction and maintenance and reclamation projects was reported. Reported sales in 1954 were five times the 1953 total, due mainly to construction activity in the area, although a part of this apparent gain was the result of increased statistical coverage of this commodity.

Otoe.—The Nebraska City brick plant of Western Brick & Supply Co. worked 290 days and employed 18 men in manufacturing building brick and other heavy clay products. The company also employed 2 men for 290 days in mining operations of its clay pit near the brick plant. Clay production reached 10,000 tons in 1954, a 4-percent increase over 1953.

Red Willow.—As a result of demands for raw material for concrete aggregate by the construction industry, the sales of sand and gravel and crushed stone in 1954 showed a marked increase over the 1953 total. Sand and gravel for building and paving purposes was produced by Davidson & Merritt Sand & Gravel Co., Frank Gillen, Midwest Sand & Gravel Co., and contractors engaged in Federal Bureau of Reclamation projects.

Crushed sandstone used as riprap was also reported by a contractor working on a Government contract.

Richardson.—Highway construction and maintenance required a higher rate of production of sand and gravel and stone in 1954 than in 1953, and the county highway department produced 67,875 tons of sand and gravel and Heebner Quarries and the Army Corps of Engineers produced 4,800 tons of crushed limestone.

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Sarpy.—The local production and consumption of sand and gravel and crushed limestone, all used as raw material for concrete aggregate in building construction and road use, continued to be the only activity of the mineral industry of the region. Lyman-Richey Sand & Gravel Corp. operated its No. 2 and No. 7 washing and crushing plants, and Richfield Sand & Gravel Co. produced structural sand and gravel on a smaller scale. In addition, General Rock, Inc., produced crushed limestone in connection with highway-construction projects.

Thayer.—Agricultural limestone was produced by Thayer Quarries from a quarry near Hebron, and Mark A. Bergt quarried building sand and paving gravel from a pit near Deshler.

Webster.—The Red Cloud shale pit of the Western Brick & Supply Co. was worked occasionally when clay was needed for blending at the company Hastings brick plant.

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The Mineral Industry of Nevada

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Nevada Bureau of Mines.

By R. E. Wallace [1] and J. D. McLenegan [1]

NEVADA mineral production in 1954 reached an alltime high total value of $89 million and represented a 21-percent increase over $73 million, the total value in 1953. This was the fifth consecutive year of advance in value of the State's mineral output. Metals provided $76.3 million or 86 percent of Nevada's total value of minerals produced in 1954 and $61.6 million or 84 percent in 1953. Copper continued to lead other Nevada metals in value in 1954 and increased 17 percent over the 1953 value. The output of tungsten concentrate, in second place among Nevada's minerals, increased notably over 1953, aided by the Government purchase program. The 1954 manganese ore and concentrate yield was nearly four times that of 1953 due largely to the return to fulltime operations of the chief manganese-concentrate producer, Manganese, Inc., after rebuilding of its plant that was destroyed by fire in 1953. Mercury output increased substantially in 1954, owing largely to an abrupt price increase that followed the decline in average price in 1953.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

In contrast to the advances by some metals, the production of gold and silver, affected by continued fixed prices, slumped in 1954. Continued low average prices for lead and zinc caused declines in the production of both metals and reflected in lowered production of byproduct silver. The shipments of molybdenum concentrate, a byproduct of copper production, were slightly less than in 1953.

The tonnage of molybdenum-bearing copper ores treated in 1954 diminished compared with 1953, but the total copper production increased in Nevada in 1954 due to the output of the Anaconda Copper Mining Co. Yerington operation, which was opened late in 1953.

Iron-ore output in Nevada declined slightly in 1954. Shipments for domestic consumption remained near the level of 1953, but consignments under contracts to Japan fell considerably.

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Regardless of the adverse effects of the iron and steel strike, the overall production of nonmetallic minerals for Nevada increased slightly over the previous year. Sand and gravel and stone were the chief nonmetallic commodities produced and more than doubled their production over the previous year. Diatomite, marl, and barite advanced in production through further utilization in industry. Although the production of fluorspar and lime made a record in 1953, their close association with the iron industry caused a moderate decline in this year's output. The production of magnesite and brucite was also adversely affected.

With few exceptions the nonmetallic minerals were used by producers themselves. Stockpiling while awaiting a favorable market had significant influence on the production trends for the State. With the exception of sand and gravel and stone, the production of these commodities in California is a serious competitor for Nevada's output.

Owing to the above reasons and to changing utilization in manufacturing processes, the production of clay, talc, and soapstone displayed sharp declines, while moderate declines in gypsum and pumice were reported.

TABLE 1.—Mineral production in Nevada, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Antimony ore and concentrate.....gross weight	20	(2)	4	(2)
Barite	99,525	$614,686	83,833	$517,492
Clays	(2)	(2)	5,478	8,787
Copper (recoverable content of ores, etc.)	61,850	35,501,900	70,217	41,428,030
Gold (recoverable content of ores, etc.)...troy ounces	101,799	3,562,965	79,067	2,767,345
Gypsum	701,584	1,975,053	654,422	2,217,273
Iron ore (usable).....long tons, gross weight	444,081	2,647,859	351,250	2,024,794
Lead (recoverable content of ores, etc.)	4,371	1,145,202	3,041	833,234
Manganese ore (35 percent or more Mn) gross weight	[3] 20,150	1,684,555	(3)	(3)
Manganiferous ore (5 to 35 percent Mn).....do	[3] 25,064	431,559	12,870	165,075
Mercury.....76-pound flasks	3,254	628,120	4,974	1,315,076
Petroleum (crude).....thousand 42-gallon barrels			33	40,000
Pumice and pumicite	21,269	86,366	(2)	(2)
Sand and gravel	2,266,064	2,088,948	3,531,291	2,956,537
Silver (recoverable content of ores, etc.)...troy ounces	697,086	630,898	560,182	506,993
Stone	[4] 1,035,568	[4] 1,399,529	1,832,781	2,010,592
Talc and soapstone	10,906	72,971	5,866	53,582
Tungsten concentrate.....60-percent WO_3 basis	3,683	13,824,238	5,331	20,048,448
Zinc (recoverable content of ores, etc.)	5,812	1,336,760	1,035	223,560
Undistributed: Brucite, diatomite, fluorspar, gem stones, lime, magnesite, calcareous marl, molybdenum, perlite, salt, sulfur ore, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2)		5,891,368		12,435,384
Total Nevada		73,523,000		[5] 89,138,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Value included with "Undistributed."

[3] Shipments to Government low-grade depots and custom mills not included, but quantity and value for this material is as follows: 1953—manganese ore, 360 short tons, $17,350, and manganiferous ore, 8,777 short tons, $166,615; 1954—manganese ore, 872 short tons, $63,775, and manganiferous ore, 1,187 short tons, $45,812.

[4] Excludes limestone used in lime.

[5] Total has been adjusted to eliminate duplication in the value of raw material used in the manufacture of cement.

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TABLE 2.—Average prices of selected mineral commodities in Nevada 1945–49 (average) and 1950–54[1]

Commodity	1945–49 (average)	1950	1951	1952	1953	1954
Copper[2]—cents per pound	17.7	20.8	24.2	24.2	28.7	29.5
Fluorspar (average all types) dollars per ton	33.05	35.22	41.41	46.35	49.48	50.21
Gold[3]—dollars per troy ounce	35.00	35.00	35.00	35.00	35.00	35.00
Iron ore (average value at mine) dollars per long ton	3.54	4.99	5.46	6.09	6.76	6.99
Lead[2]—cents per pound	13.8	13.5	17.3	16.1	13.1	13.7
Mercury[4]—dollars per 76-pound flask	94.56	81.26	210.13	199.10	193.03	264.39
Molybdenum concentrate, 90 percent MoS_2 concentrate—cents per pound MoS_2	46.8	59.0	60.0	60.0	60.0	63.0
Silver[5]—cents per troy ounce	86.6	90.5+	90.5+	90.5+	90.5+	90.5+
Tungsten concentrate dollars per short-ton unit WO_3	23.89	28.25	61.02	63.44	[6] 62.46	[6]62.61
Zinc[2]—cents per pound	12.02	14.2	18.2	16.6	11.5	10.8

[1] Prices are discussed in detail in the commodity chapters of volume I, Minerals Yearbook.
[2] Yearly average weighted price of all grades of primary metal sold by producers. Price in 1946–47 includes bonus payments by Office of Metals Reserve for overquota production.
[3] Price under authority of Gold Reserve Act of Jan. 31, 1934.
[4] Average quoted price at New York.
[5] Treasury buying price for newly mined silver 1943 to June 30, 1946—$0.71111111; July 1, 1946, to Dec. 31, 1947—$0.905; 1948–54—$0.9050505.
[6] Based on average of GSA purchases.

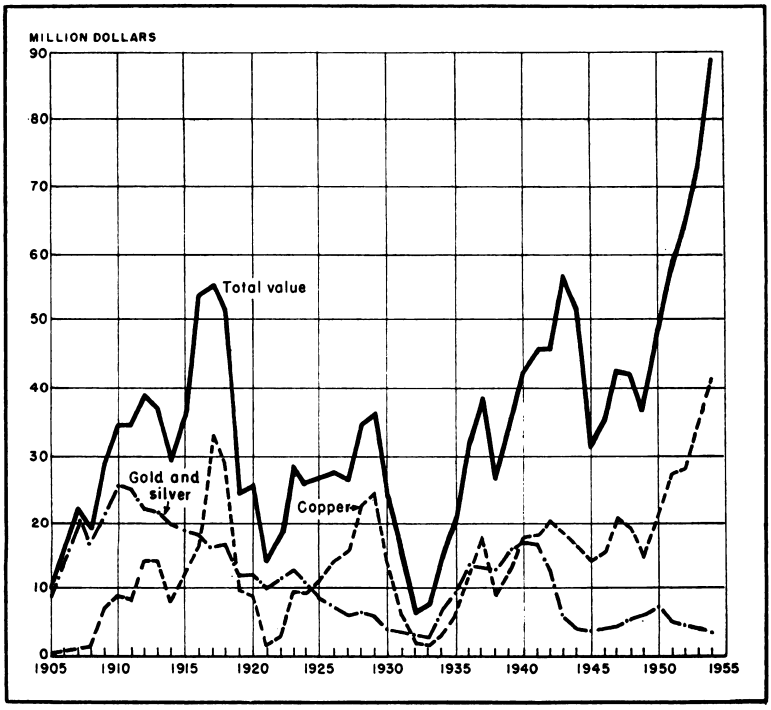

FIGURE 1.—Total value of mineral production and value of gold, silver and copper, 1905–54.

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CONSUMPTION AND MARKETS

Nevada ranked 28th among the 48 States, Alaska, and the District of Columbia in mineral production. As a mineral consumer the State ranked much lower owing to the relatively small population and limited industrial activity. However, its proximity to smelting and manufacturing centers, particularly in Utah and California, placed Nevada in the position of a supplier of industrial minerals to an expanding western economy, as well as a source of major metals.

Minerals produced in Nevada, part or all of which were consumed or further processed within the State, included: Manganese ore and concentrate, diatomite, clay, gypsum, limestone magnesite, pumice and pumicite, volcanic cinder, sand and gravel, expanded perlite, stone and salt.

Marketing the State's minerals followed a wide variety of patterns. Nevada's principal copper producer, and the State's largest individual industrial establishment, converted the raw mineral to blister copper, which was shipped to eastern refineries. Producers of gold sold the metal directly to the United States Mint. Mercury producers usually marketed the metal to consumers and distributors. Other metal-mine operators sold ore direct to smelters or to custom mills. The mills, in turn, disposed of their products to smelters, such as lead and zinc concentrates, or to the General Services Administration (GSA), with tungsten concentrate as an example. Some producers of nonmetallic minerals disposed of the raw material to grinding mills. Other producers having a product such as marl sold directly to agriculturists after crushing. Some commodities were converted into a finished product by other operators, as in the instance of a wallboard manufacturer that also mined and processed gypsum.

Custom Mills and Smelters.—Continued high production of tungsten sustained custom milling in Nevada in 1954. There were 7 principal mills, operating in 5 counties, that accepted tungsten ores of milling grade.

Combined Metals Reduction Co. received manganese and manganiferous ores, some of which contained lead and zinc, for custom milling at its Caselton mill in Lincoln County.

Kennecott Copper Corp., Nevada Mines Division, treated the copper ore of Consolidated Coppermines Corp. under contract of its McGill concentrator and smelter and smelted ores containing gold, silver, and copper from various mining districts throughout the State.

Mineral Brokers.—Much of the iron ore shipped to Japan from Nevada mines was consigned by brokers and traders through their California establishments. A noteworthy tonnage of tungsten concentrate, largely accumulated small-lot purchases, was marketed through brokers in California tungsten-milling areas—Bishop, in particular. Gold and silver bullion and mercury purchases by Nevada brokers or bullion buyers were small and infrequent.

GOVERNMENT PARTICIPATION

Defense Minerals Exploration Administration Program.—The DMEA program, established to provide Government aid in locating new sources of strategic and critical minerals in the United

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States, continued in 1954. Twenty-seven contracts, with an approved total cost of $1,650,599, were in effect in Nevada for all or part of 1954. The Government agreed to advance $989,716 toward these projects. Four projects were initiated during the year; of these, 2 were tungsten deposits, 1 fluorspar, and 1 uranium. Bureau of Mines and Geological Survey teams operating out of Reno, Nev., were part of the program.

Other Government Assistance Activities.—The Defense Materials Procurement Agency (DMPA), under authority of the Defense Production Act of 1950, continued to bolster a continuity of strategic mineral production in Nevada through purchase contracts with producers of copper, titanium, and manganese. Although no new contracts were negotiated by DMPA with Nevada companies in 1954, the contracts initiated in 1953 remained in effect in 1954. The purchase contracts are listed in table 4.

General Service Administration Purchase Depots.—The GSA did not maintain purchase depots in Nevada for its stockpiles of strategic minerals. In lieu of established depots within the State carlots of manganese ore for high-grade stockpiles were received by the Government at railheads, and tungsten concentrate was purchased at designated shipping points in the tungsten-producing districts. Shipments of Nevada manganese and manganiferous ores were accepted by the Government at Arizona, Montana, and New Mexico low-grade depots.

NEW PLANTS OR PROJECTS

The most exciting development of 1954 was the first discovery of commercial quantities of oil in Nevada. The Shell Oil Co. Eagle Springs Unit No. 1 was completed in June for a representative initial production of 373 barrels of oil per day. The crude had a high pour point of 80°–85° F. The gravity was 28.3° API and in August the gas-oil ratio was 40 cubic feet per barrel. The asphalt content was high.

The well was Shell's first test in Nevada and the first well drilled in Railroad Valley. The unit is in Nye County near Warm Springs, and over 95 percent is on Federal land.

FLOW OF MINERALS

Domestic Shipments.—Interstate movement of mineral commodities in 1954 was predominantly shipment from Nevada. Shipments of metallic ore, concentrate, and precipitate, blister copper, mercury, ferromanganese, titanium sponge, barite, fluorspar, gypsum, industrial sand, lime, limestone, brucite, magnesium compounds, crude perlite, and diatomite comprised a large tonnage of outgoing materials. The principal domestic minerals entering Nevada were: Mineral fuels, cement, sulfur ores, coke and magnesium for titanium plants, and salt for producing chlorine. Railroads transported the greater tonnage of minerals in interstate movements, although motortrucks hauled California sulfur ore to Nevada.

Imports and Exports.—Iron ore and magnesium compounds were the principal Nevada mineral products exported in 1954. These materials were transported by rail to coastal ports and thus were involved

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TABLE 3.—Defense Minerals Exploration Administration contracts in effect in April 1954

Operator	Status	Property	County	District	Commodity	Government participation	Total contract
Tungsten Mining Co	A	Hilltop	Churchill	Alpine (Clan Alpine)	Tungsten	$24,201	$32,268
Murray A. Schutz (Marshal Mining Co.).	B	Marshall (Nevada-Bellevue)	Elko	Contact (Salmon River)	Copper	37,311	74,621
Knowles Bros. (Garnet Tungsten Mining Co.).	B	Garnet No. 1 and 2	do	Alder	Tungsten	16,320	21,760
United Minerals Corp	B	Rip Van Winkle	do	Merrimac	Lead-zinc	26,750	53,500
Frank Bullock	[1] B	Lucky Boy-Jackson	do	Delano	do	10,350	20,700
W. F. Dunnigan	B	Red Rock	Esmeralda	Fish Lake Valley	Mercury	6,694	8,925
Consolidated Eureka Mining Co	B	Diamond	Eureka	Eureka	Lead	28,525	57,050
Aubrey Minney	B	McAdoo	Humboldt	Bottle Creek	Mercury	13,200	17,600
Platora Uranium Corp	A	Moonlight	do	Kings River Valley	Uranium	15,563	20,751
G. W. Snyder & G. W. Snyder, Jr	[1] B	Lucky Strike	Lander	Battle Mountain	Lead-zinc	13,897	27,794
Kaiser Aluminum & Chemical Corp	A	Iowa Canyon	do	Iowa Canyon	Fluorspar	2,510	5,020
Keever, Frank B	[1] B	Bentley	do	Battle Mountain	Lead-zinc	10,114	20,228
Y. Z. Mining Co	A	Schofield	Lincoln	Tem Piute	Tungsten	29,700	39,600
Bristol Silver Mines Co	B	Bristol	do	Jack Rabbit (Bristol)	Lead-zinc	97,899	195,797
Idamic Mines, Inc	C	Lucky Star	do	do	Manganese	16,620	22,160
Comet Mines, Inc	B	Comet	do	Comet	Lead-zinc	95,000	190,000
Ely Valley Mines, Inc	[1] B	Ely Valley	do	Pioche (Ely)	do	43,100	86,200
Raymond-Combined Mines Co	B	Linevada, Prince Henry, Mother Lode, Doris.	do	do	do	54,233	108,466
F. M. Anderson & Associates	C	Stormy Day	Pershing	Hooker	Tungsten	16,230	21,640
Nevada Uranium Co	B	Stalin's Present	do	Rocky Canyon	Uranium	8,231	9,145
Hamilton Consolidated Mines Corp	[1] B	Rocco-Homestake	White Pine	White Pine	Lead-zinc	13,370	26,740
Walker Corp	B	Ward	do	Ward	Lead-zinc-copper	66,155	132,310
Cherry Creek Tungsten Mining Co	[1] B	Cherry Creek	do	Cherry Creek	Tungsten	56,250	75,000
Metallics Unlimited	[1] C	Pine Nut	do	do	do	10,650	14,200
M. I. A. Mines Co	B	Minerva	do	Shoshone	do	128,550	171,400
Mount Wheeler Mines, Inc	C	Mount Wheeler	do	Mount Washington	do	127,818	170,424
Cavigilia & Parodi	B	Essex	do	Nevada	Manganese	20,475	27,300

A—Initiated in 1954. B—Initiated before 1954. C—Initiated before and amended in 1954.
[1] Inactive in 1954.

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TABLE 4.—Contracts for purchase of minerals under the Defense Production Act, as of Dec. 31, 1954

Contractor	County	Commodity	Contingent purchase commitment (short tons)	Financing	
				Amount	Type
Anaconda Copper Mining Co.	Lyon	Copper	128,000		
Titanium Metals Corp. of America.	Clark	Titanium	1,500	$15,000,000	Advance.
Manganese, Inc.	Clark	Manganese concentrate.	[3] 830,000		

Contractor	Tax amortization	Approximate term of contract	Date production starts	Commitment purchase price
Anaconda Copper Mining Co.	75 percent	6 years	Dec. 6, 1953	$0.255 or market a pound.[1]
Titanium Metals Corp. of America.	90 percent	5 years	May 1, 1952	$5.00 or market a pound.[2]
Manganese, Inc.		9 years	Jan. 1, 1952	$1.50 a long ton unit of contained Mn.[4]

[1] Contracted at over ceiling price (ceiling price was 24½ cents a pound for most producers).
[2] Sponge metal. Contract has clause to allow for differential between ingot and sponge purchased.
[3] Long tons.
[4] Includes escalator clause.

in interstate flow of minerals. The basic material for Nevada titanium production was largely imported rutile.

EMPLOYMENT IN MINERAL INDUSTRIES

Employment.—According to data released by the State inspector of mines,[2] the total number of persons employed for wages or contracting in Nevada mines, mills, and smelters as of June 30, 1954, was 6,267 at 137 installations, whereas 5,763 persons were employed at 155 facilities as of June 30, 1953, and 5,054 persons at 169 facilities as of June 30, 1952. The heaviest gain in 1954 was made in Clark County, where 1,795 persons were employed compared with 1,346 in 1953. The Bureau of Labor Statistics reported an estimated average of 4,800 persons employed exclusively at Nevada mines in 1954 compared with an estimated average of 4,400 in 1953 and 4,300 in 1952.

Accidents.—The number of fatal accidents in Nevada mineral establishments in 1954 decreased 70 percent compared with 1953 and was the lowest for several years. The number of nonfatal accidents increased 15 percent, which paralleled the increase in employment in the mineral industry in 1954.

Wages.—The average weekly earnings in Nevada mines, reported by the Bureau of Labor Statistics, was $87.77, compared with $92.77 in 1953 and $88.13 in 1952.

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—A small lot of antimony ore, purportedly from Nye County was shipped to a Texas smelter and represented the only activity in Nevada for 1954. Antimony-bearing materials, however

[2] State Inspector of Mines, State of Nevada, 27th Report.

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(principally as lead ore and tailing, from the Candelaria district, Mineral County), were shipped to smelters.

Cadmium.—Cadmium was a constituent of the zinc concentrate produced in the Pioche district, Lincoln County; but the quantity of cadmium recovered from these concentrates at zinc smelters was not recorded.

Copper.—Nevada copper production increased 14 percent in quantity and 17 percent in value over 1953. Although the Robinson district, White Pine County, supplied 63 percent of the recoverable copper produced in Nevada in 1954, the yield dropped 27 percent from 1953, reflecting decreases in tonnage and grade of ore treated. The principal production was from Kennecott Copper Corp., Nevada Mines Division, Ruth (Liberty) and Kimbley pits; and the Consolidated Coppermines Corp., Morris and Brooks pits, and the Ruth (Liberty) pit extension (operated by Kennecott Copper Corp.). Ore from these mines was beneficiated at the Kennecott Copper Corp. McGill concentrator. The copper concentrate produced and some copper, gold, and silver ores with fluxing qualities were smelted at Kennecott's McGill smelter. The Yerington District, Lyon County, was second in output, and its increased production aided materially in bringing the State total copper production above 1953. The Anaconda Copper Mining Co., Yerington open-pit mine and leaching plant, in that district, was the leading individual copper producer in the State. The company operated this mine and plant for the first full year in 1954 following the initial production in December 1953.

Shipments of direct-smelting copper ore were made from small properties in Clark, Elko, Humboldt, Lander, and Washoe Counties. The more consistent shippers in this group were the Marshall Mining

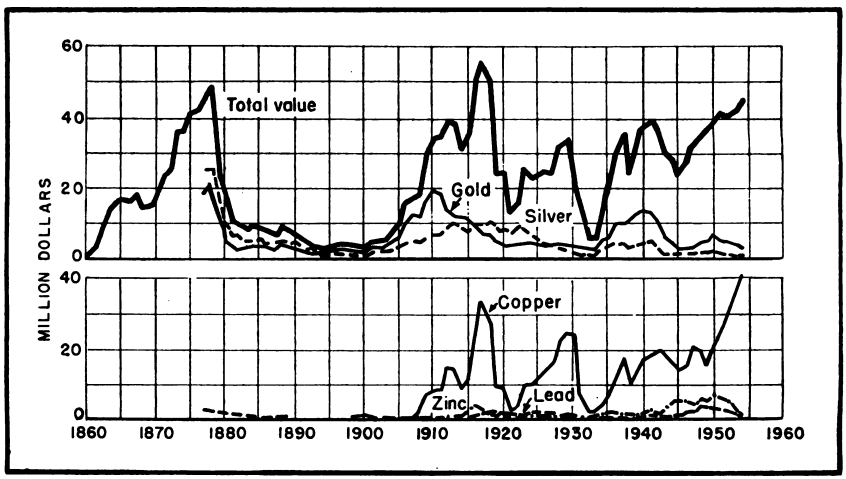

FIGURE 2.—Value of mine production of gold, silver, copper, lead, and zinc in Nevada, 1860–1954.

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Co., Marshall mine, Contact district, Elko County, and lessees of the Copper Canyon Mining Co. in the Copper Basin area of the Battle Mountain district. Byproduct copper fell appreciably below the 1953 yield owing largely to decreased production of lead-zinc ores in Lincoln County.

Gold.—Gold production declined 22 percent in quantity and value from 1953 owing chiefly to its lower output as a byproduct from base-metal ores, particularly copper. Gold from placer deposits and precious-metal ores, however, actually increased 6 and 21 percent in quantity and value, respectively, over 1953. Base-metal ores contributed 46 percent of the State's total gold production, precious-metal ores 31 percent, placer material 22 percent, and tailing and miscellaneous materials 1 percent.

In 1954, of the 17 placer mines in operation 1 was worked by a bucketline dredge, 7 by mechanical excavators delivering gravel to non-floating washing plants, 3 by underground methods, and 6 by small-scale hand methods.

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc, 1945–49 (average), 1950–54, and total, 1859–1954, in terms of recoverable metals [1]

Year	Mines producing [2]		Material sold or treated [3] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945–49 (average)	263	30	6,160,347	102,788	$3,597,573	1,452,368	$1,249,706
1950	325	27	7,745,119	178,447	6,245,645	1,537,217	1,391,259
1951	199	12	7,183,733	121,036	4,236,260	981,669	888,460
1952	114	11	7,313,697	117,203	4,102,105	941,195	851,829
1953	125	9	8,027,402	101,799	3,562,965	697,086	630,898
1954	119	17	9,843,202	79,067	2,767,345	560,182	506,993
1904–54 [4]			(5)	14,618,671	359,672,588	310,876,020	212,333,865
1859–1954			(5)	26,445,547	604,155,821	599,288,869	549,492,088

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	46,823	$17,083,075	8,203	$2,312,760	20,361	$5,006,936	$29,250,050
1950	52,569	21,868,704	9,408	2,540,160	21,606	6,136,104	38,181,872
1951	56,474	27,333,416	7,148	2,473,208	17,443	6,349,252	41,280,596
1952	57,537	27,847,908	6,790	2,186,380	15,357	5,098,524	40,036,746
1953	61,850	35,501,900	4,371	1,145,202	5,812	1,336,760	42,177,725
1954	70,217	41,428,030	3,041	833,234	1,035	223,560	45,759,162
1904–54 [4]	2,212,292	714,499,992	367,711	55,709,489	466,442	89,205,928	1,431,421,862
1859–1954	2,214,218	715,146,620	605,502	78,346,051	466,442	89,205,928	2,036,346,508

[1] Includes recoverable metal content of gravel, washed (placer operations); ore milled; old tailing or slimes re-treated; and ore, old tailings, and slag shipped to smelters during calendar year indicated.
[2] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[3] Does not include gravel washed.
[4] From 1904 when first satisfactory annual canvass of mine production was made to 1954, inclusive.
[5] Figure not available.

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TABLE 6.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties, in terms of recoverable metals

County	Mines producing [1]		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Churchill	4		17	$595	8,724	$7,896
Clark	5		24	840	358	324
Elko	10	1	72	2,520	65,344	59,140
Esmeralda	1		[2] 10	[2] 350	[2] 70	[2] 63
Eureka	3	2	1,118	39,130	75,181	68,043
Humboldt	4	1	20	700	268	243
Lander	13	3	37,687	1,319,045	19,490	17,630
Lincoln	10		2,909	101,815	140,100	126,798
Lyon	2	1	587	20,545	332	300
Mineral	12	1	821	28,735	81,112	73,410
Nye	17	4	901	31,535	41,421	37,488
Ormsby	1		[2]	[2]	[2]	[2]
Pershing	5	3	248	8,680	122	110
Storey	3		405	14,175	7,169	6,488
Washoe	6		57	1,995	194	176
White Pine	23	1	34,191	1,196,685	120,307	108,884
Total	119	17	79,067	2,767,345	560,182	506,993

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Churchill			10,600	$1,452	400	$43	$9,986
Clark	7,200	$2,124	731,000	100,147			103,435
Elko	136,400	40,238	796,100	109,066	140,000	15,120	226,084
Esmeralda							[2] 413
Eureka	1,200	354	1,009,500	138,302	45,800	4,946	250,775
Humboldt	2,000	590	300	41			1,574
Lander	125,400	36,993	1,200	164			1,373,832
Lincoln	128,600	37,937	2,300,800	315,210	1,712,900	184,993	766,753
Lyon	52,060,800	15,363,836					15,384,681
Mineral	2,000	590	796,900	109,175	169,200	18,274	230,184
Nye	800	236	35,500	4,864	1,100	119	74,242
Ormsby							[2]
Pershing							8,790
Storey							20,663
Washoe	1,800	531	8,200	1,123	600	65	3,890
White Pine	87,947,800	25,944,601	391,900	53,690			27,303,860
Total	140,434,000	41,428,030	6,082,000	833,234	2,070,000	223,560	45,759,162

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[2] Ormsby County lode combined with that of Esmeralda County to avoid disclosure of individual output.

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1954, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	6,428	69,330	5,859	452	60
February	5,153	47,767	4,901	282	35
March	5,469	33,171	6,181	183	34
April	5,620	45,630	5,861	150	47
May	6,168	37,261	5,976	175	90
June	6,585	48,328	6,509	170	145
July	8,430	51,067	5,925	226	196
August	6,156	59,366	4,039	380	189
September	7,332	37,880	5,901	168	30
October	7,421	43,819	6,158	234	18
November	7,497	53,827	6,437	422	106
December	6,808	32,736	6,470	199	85
Total	79,067	560,182	70,217	3,041	1,035

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TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1954, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	35	170,442	23,757	13,297	----------	1,100	----------
Dry gold-silver	3	369	423	13,413	700	1,200	----------
Dry silver	14	10,277	454	69,339	600	17,300	5,300
Total	52	181,088	24,634	96,049	1,300	19,600	5,300
Copper	23	9,615,051	34,201	111,244	140,167,800	----------	----------
Copper-lead-zinc	1	1,342	17	28,596	79,500	259,000	231,000
Lead	24	9,470	1,463	151,085	29,000	2,564,400	141,600
Lead-zinc	3	20,365	543	68,787	47,800	1,389,500	946,700
Zinc	1	505	8	1,352	----------	5,200	39,100
Total	52	9,646,733	36,232	361,064	140,324,100	4,218,100	1,358,400
Other "lode" material:							
Old tailing [2]	19	13,314	583	68,403	2,900	622,900	210,200
Copper precipitate and manganese ore [3 4]	4	135	361	31,870	103,400	495,600	496,100
Old slag	1	6	----------	10	----------	1,000	----------
Lead residue	1	1,926	11	311	2,300	724,800	----------
Total	25	15,381	955	100,594	108,600	1,844,300	706,300
Total "lode" material	129	9,843,202	61,821	557,707	140,434,000	6,082,000	2,070,000
Gravel (placer operations)	17	(5)	17,246	2,475	----------	----------	----------
Total, all sources	146	----------	79,067	560,182	140,434,000	6,082,000	2,070,000

[1] Details will not necessarily add to totals because some mines produce more than 1 class of material.
[2] Metal recovered, by class of old tailings, as follows: Gold, 87 tons—131 ounces gold, 86 ounces silver; gold-silver, 2,186 tons—152 ounces gold, 5,325 ounces silver; silver, 11,029 tons—300 ounces gold, 62,854 ounces silver, 2,000 pounds copper, 622,000 pounds lead, 210,200 pounds zinc; copper, 11 tons—9 ounces silver, 900 pounds copper; lead, 1 ton—129 ounces silver, 900 pounds lead.
[3] Combined to avoid disclosure of individual output.
[4] Manganese-ore tonnage not included.
[5] 3,014,130 cubic yards.

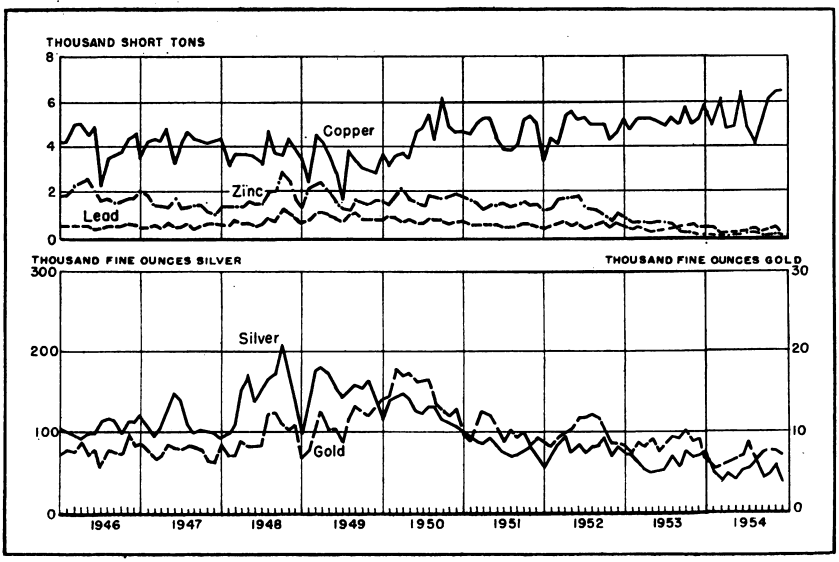

FIGURE 3.—Mine production of gold, silver, copper, lead, and zinc, 1946–54, by months, in terms of recoverable metals.

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TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of gross metal content

Class of material	Material shipped or treated (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
CONCENTRATE SHIPPED TO SMELTERS						
Dry gold	3	20	97	3	1,039	----------
Dry silver	258	44	27,458	779	17,772	6,700
Copper and copper precipitates [1]	256,766	34,277	114,677	141,825,940	----------	----------
Lead	195	4	2,274	1,815	222,282	351
Lead-zinc	1,864	527	51,863	32,241	1,258,167	850,326
Zinc	49	8	1,352	----------	5,370	41,647
Total: 1954	259,135	34,880	197,721	141,860,778	1,504,630	899,024
1953	291,390	63,748	521,753	123,223,326	6,921,893	11,120,513
ORE, ETC., SHIPPED DIRECTLY TO SMELTERS						
Dry gold:						
Crude ore	6,164	2,188	8,448	13	210	----------
Old tailings	84	110	64	----------	----------	----------
Dry gold-silver:						
Crude ore	369	423	13,433	752	1,937	----------
Old tailings	6	18	791	----------	----------	----------
Dry silver:						
Crude ore	3,123	419	45,521	94	----------	----------
Old tailings	10,983	300	62,314	2,657	624,761	262,231
Copper:						
Crude ore and precipitates [1]	66,815	799	5,904	2,875,007	----------	608
Old tailings	11	----------	9	1,042	----------	----------
Copper-lead-zinc: Crude ore	1,342	17	28,596	96,604	263,227	292,331
Lead:						
Crude ore	6,362	1,459	148,811	37,088	2,423,043	188,973
Old tailings	1	----------	129	10	941	102
Old slag	6	----------	10	24	1,094	----------
Residue	1,926	11	311	3,069	755,022	----------
Lead-zinc: Crude ore	1,182	16	16,924	27,244	155,699	196,075
Total: 1954	98,374	5,760	331,265	3,043,604	4,225,934	940,320
1953	109,856	3,756	193,839	3,075,995	1,995,713	1,168,101

[1] Combined to avoid disclosure of individual output.

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TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals

A. For material treated at mills

	Material treated (short tons)	Recoverable in bullion		Concentrate shipped to smelters [1] and recoverable metals					
		Gold (fine ounces)	Silver (fine ounces)	Concentrate (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Churchill	414	11	51	6	6	8,656		3,800	200
Clark		8	5						
Elko	483			52	1	577		33,600	2,900
Esmeralda and Ormsby [2]	5	7	18						
Humboldt	143	14	₱6	1	1	191		300	
Lander	161,751	20,847	2,633						
Lincoln	21,973			5,314	897	86,075	28,700	1,888,400	1,327,800
Lyon	3,641,670	135	92	33,422			52,080,800		
Mineral	6,857	1		254	42	18,886	600	14,500	5,100
Nye	697	184	23	29	1	1,020		27,700	
Pershing	160	163	113						
Storey	3,751	384	7,028	1	16	13			
Washoe	87	57	21	3		10	1,800		
White Pine	5,906,837			223,344	33,420	105,526	85,384,300	3,000	
Total: 1954	9,744,828	21,761	9,990	262,426	34,384	220,954	137,496,200	1,971,300	1,336,000
1953	7,917,546	19,305	2,177	291,390	62,495	504,348	120,716,600	6,788,800	10,663,800
BY CLASSES OF MATERIAL TREATED									
Dry gold:									
Crude ore	164,278	21,603	5,422	3	20	97		1,000	
Old tailings	3	24	27						
Dry gold-silver:									
Old tailings	2,180	134	4,538						
Dry silver:									
Crude ore	7,154			258	44	27,458	600	17,300	5,300
Old tailings	46		3	9		536		3,400	2,900
Copper	9,548,371			256,766	33,420	105,504	137,466,900		
Lead	3,108			195	4	2,274	1,300	213,400	
Lead-zinc and manganese ore [2 3]	19,183			5,146	888	83,733	27,400	1,731,000	1,288,700
Zinc	505			49	8	1,352		5,200	39,100
Total 1954	9,744,828	21,761	9,990	262,426	34,384	220,954	137,496,200	1,971,300	1,336,000
BY CLASSES OF CONCENTRATE SHIPPED TO SMELTERS [1]									
Dry gold				1	16	13			
Dry silver				258	44	27,458	600	17,300	5,300
Copper and copper precipitates [2]				256,766	33,420	105,504	137,466,900		
Lead				4,322	829	80,089	20,300	1,912,000	216,700
Zinc				1,079	75	7,890	8,400	42,000	1,114,000
Total 1954				262,426	34,384	220,954	137,496,200	1,971,300	1,336,000

For footnotes see end of table.

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TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (exept placer) and classes of material processed, in terms of recoverable metals—Continued

B. For materials shipped directly to smelters

	Material shipped (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Churchill	13		17		6,800	200
Clark and Esmeralda [2]	1,983	19	405	7,200	731,000	
Elko	4,937	45	64,763	136,400	762,500	137,100
Eureka	2,907	970	75,171	1,200	1,009,500	45,800
Humboldt	25	1	70	2,000		
Lander	1,698	460	14,698	125,400	1,200	
Lincoln	8,565	2,012	54,025	99,900	412,400	385,100
Mineral	10,440	757	62,210	1,400	782,400	164,100
Nye	3,215	638	40,332	800	7,800	1,100
Storey	1	5	128			
Washoe	22		163		8,200	600
White Pine	64,568	769	14,781	2,563,500	388,900	
Total: 1954	98,374	5,676	326,763	2,937,800	4,110,700	734,000
1953	109,856	3,689	188,149	2,983,400	1,953,200	960,200
BY CLASSES OF MATERIAL						
Dry gold:						
Crude ore	6,164	2,134	7,778		100	
Old tailings	84	107	59			
Dry gold-silver:						
Crude ore	369	423	13,413	700	1,200	
Old tailings	6	18	787			
Dry silver:						
Crude ore	3,123	410	41,882			
Old tailings	10,983	300	62,314	2,000	618,600	207,300
Copper:						
Crude ore and precipitates [3]	66,815	781	5,740	2,804,300		
Old tailings	11		9	900		
Copper-lead-zinc: Crude ore	1,342	17	28,596	79,500	259,000	231,000
Lead:						
Crude ore	6,362	1,459	148,811	27,700	2,351,000	141,600
Old tailings	1		129		900	
Slag	6		10		1,000	
Residue	1,926	11	311	2,300	724,800	
Lead-zinc: Crude ore	1,182	16	16,924	20,400	154,100	154,100
Total 1954	98,374	5,676	326,763	2,937,800	4,110,700	734,000

[1] Excludes concentrate treated only by amalgamation and/or cyanidation.
[2] Combined to avoid disclosure of individual output.
[3] Manganese-ore tonnage not included.

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TABLE 11.—Gold and silver produced at placer mines, 1945–49 (average) and 1950–54, in fine ounces, in terms of recoverable metals

Year	Material handled (cubic yards)	Gold (fine ounces)	Silver (fine ounces)	Total value	Average gold value per cubic yard
1945–49 (average)	1,402,928	9,493	3,134	$334,841	$0.237
1950	5,243,450	36,378	9,800	1,282,099	.243
1951	6,165,850	30,509	14,017	1,080,501	.173
1952	5,625,620	33,079	11,011	1,167,730	.206
1953	2,670,110	16,310	2,412	573,033	.214
1954	3,014,130	17,246	2,475	605,850	.200

TABLE 12.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed, and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Amalgamation and cyanidation:					
Ore	21,603	5,422			
Old tailings	158	4,568			
Total recoverable in bullion	21,761	9,990			
Concentration, and smelting of concentrates:					
Ore	34,384	220,418	137,496,200	1,967,900	1,333,100
Old tailings		536		3,400	2,900
Total	34,384	220,954	137,496,200	1,971,300	1,336,000
Direct-smelting:					
Ore [1]	5,240	263,144	2,932,600	2,765,400	526,700
Old tailings	425	63,298	2,900	619,500	207,300
Old slag		10		1,000	
Lead residue	11	311	2,300	724,800	
Total	5,676	326,763	2,937,800	4,110,700	734,000
Placer	17,246	2,475			
Grand total	79,067	560,182	140,434,000	6,082,000	2,070,000

[1] Includes copper precipitates in order to prevent disclosure of individual output.

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TABLE 13.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties and districts, in terms of recoverable metals[1]

County and district	Mines producing[2]		Lode material (short tons)	Gold (fine ounces)			Silver (lode and placer, fine ounces)[3]	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total					
Churchill County:											
Eastgate	1		60	11		11	51				$431
Holy Cross	2		354	6		6	8,656		3,800	200	8,587
Clark County:											
Charleston Mountains	1		9				6		6,200		854
Searchlight	1		1	4		4	2				142
Elko County:											
Contact	1		1,784	20		20	2,219	113,600			36,220
Delano	2		2,362	16		16	51,394	6,300	618,700	130,400	147,778
Mountain City (Cope)	1	1	10		26	26	13	500			1,069
Railroad (Bullion)	1		568	3		3	7,492	15,700	85,500	5,800	23,858
Esmeralda County (see Undistributed).											
Eureka County:											
Cortez	1		1,706	35		35	12,985	400	67,700	45,800	27,316
Lynn		2			148	148	10				5,189
Humboldt County (see Undistributed).											
Lander County:											
Battle Mountain	11	1	1,698	460	(4)	[5] 460	[5] 14,698	125,400	1,200		[5] 66,559
New Pass	1		743	205		205	31				7,203
Lincoln County:											
Atlanta	1		5,993	1,974		1,974	7,595				75,964
Ely Springs (Lone Mountain)	1		25	2		2	738				738
Groom	1		2,285	1		1	990	1,300	152,200		22,167
Jack Rabbit	2		2,518	48		48	50,112	99,900	457,600	410,600	183,540
Pioche	4		19,212	876		876	79,313	27,400	1,685,800	1,263,200	477,905
Lyon County:											
Silver City	1	1	141	135	452	587	332				20,845
Yerington	1		3,641,529					52,080,800			15,363,836
Mineral County:											
Candelaria	5		16,766	769		769	78,160	2,000	768,600	153,300	220,099
Hawthorne	4		40	20		20	669		3,300	500	1,811
Pilot Mountain	1		479	7		7	2,262		25,000	15,400	7,380
Nye County:											
Manhattan	9	2	444	249	109	358	146				12,663
Round Mountain		1	[6] 4	10	13	23	614				1,360
Ormsby County (see Undistributed).											

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Pershing County: Seven Troughs	2	----------	150	147	----------	147	109	----------	----------	----------	5,243
Storey County: Comstock Lode	3	----------	3,752	405	----------	405	7,169	----------	----------	----------	20,663
Washoe County: Olinghouse (White Horse)	4	----------	52	57	----------	57	21	----------	----------	----------	2,014
White Pine County:											
Aurum	2	----------	312	20	----------	20	1,778	600	190,400	----------	28,571
Cherry Creek	3	----------	59	5	----------	5	734	----------	----------	----------	839
Newark	2	----------	8	----------	----------	----------	236	----------	700	----------	310
Robinson	8	----------	5,970,442	34,139	----------	34,139	107,490	87,943,600	9,800	----------	27,236,853
Ward	1	----------	151	10	----------	10	3,987	3,600	24,900	----------	8,431
White Pine	2	----------	163	2	----------	2	3,192	----------	163,300	----------	25,331
Undistributed [7]	39	9	169,382	22,185	16,498	38,683	116,978	12,900	1,817,300	44,800	1,717,393
Total Nevada	119	17	9,843,202	61,821	17,246	79,067	560,182	140,434,000	6,082,000	2,070,000	45,759,162

[1] Only those districts are shown separately for which Bureau of Mines is at liberty to publish figures; other producing districts are listed in footnote and their output grouped as "Undistributed."

[2] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.

[3] Source of silver as follows: 557,707 ounces from lode mines and 2,475 ounces from placers.

[4] Included with "Undistributed" to avoid disclosure of individual company operations.

[5] Exclusive of placer output which is included with "Undistributed."

[6] Cleanup.

[7] Includes the following: Fairview in Churchill County; Eldorado Canyon, Gold Butte, Goodsprings, and Las Vegas in Clark County; Island Mountain, Loray, Merrimac, Ruby Range, and Tecoma in Elko County; Hornsilver and Silver Peak in Esmeralda County; Diamond and Eureka in Eureka County; Awakening, Battle Mountain, Dunnashee, Rebel Creek, and Varyville in Humboldt County; Bullion and Gold Run in Lander County; Comet in Lincoln County; Acme, Eagleville, and Rawhide in Mineral County; Clifford, Cloverdale, Jackson, Johnnie, Reveille, Tonopah, and Union in Nye County; Delaware in Ormsby County; Humboldt, Rabbit Hole, Rochester, Sacramento, Sawtooth, and Scossa in Pershing County; Galena and Pyramid in Washoe County; Black Horse, Chase, Granite, Osceola, and Taylor in White Pine County.

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The leading producers of gold in Nevada in the order named were: London Extension Mining Co., Goldacres mine, Bullion district, Lander County (gold ore); Kennecott Copper Corp. Nevada Mines Division, Robinson district, White Pine County (copper ore); Natomas Co., Greenan Placers, Battle Mountain district, Lander County, Nevada's only major placer operation in 1954 (dredging); and Consolidated Copper Mines Corp., Robinson district, White Pine County (copper ore). Among the smaller properties that produced noteworthy quantities of gold were, the Atlanta Gold & Uranium Co., Atlanta mine, Atlanta district, Lincoln County, and the Dayton Dredging Co. placer mine at Dayton, Lyon County, worked by dragline and a nonfloating washing plant.

Iron Ore.—Several contracts for delivery of Nevada iron ore to Japan were in force in 1954 but the quantity and value of the ore that was shipped fell 21 and 24 percent, respectively, from 1953. Of the total iron ore shipped from Nevada mines, 49 percent was for export, and to be used in blast furnaces; 50 percent went to domestic iron and steel plants, and 1 percent was for refractories and miscellaneous uses. Shipments for domestic consumption remained near the level of 1953. The entire output was magnetite, the yield from 7 open-pit mines in 5 counties; the iron content averaged 62.8 percent, compared with 63.1 percent in 1953.

The leading producers in 1954 were Dodge Construction, Inc., Segerstrom & Heizer mine, Mineral Basin district, and Parker Bros., Thomas-pit extension, Antelope district, both in Pershing County; and A & B Mining Co., Iron King (DeLong) mine, Jungo district, Humboldt County.

Lead.—Low lead prices in 1954, though slightly higher than in 1953, contributed to the reduced output of lead from Nevada ores. The Pioche district, Lincoln County, supplied 28 percent of Nevada's recoverable lead, largely from milling grade lead-zinc and manganese ores. Combined Metals Reduction Co., operator of the Caselton mine and mill in the Pioche district, was the State's principal producer of recoverable lead in lead and zinc concentrates. A few small mines shipped direct-smelting lead ore and complex ores containing lead, but the majority of such properties operated sporadically. The more consistent shippers in the small-producer category included: Consolidated Eureka Mining Co., Consolidated Eureka (Diamond Excelsior) mine, Eureka district, Eureka County (lead ore); Ala & Daz, Delno mine, Delano district, Elko County (lead ore); Bristol Silver Mines Co., Bristol mine, Jack Rabbit district, Lincoln County (copper-lead-zinc ore); and G. A. Peterson and Joe Marinelli, New Potosi mine, Candelaria district, Mineral County (antimonial lead ore). Substantial quantities of lead were contained in miscellaneous material treated at smelters. Included were residue from the Manganese, Inc., nodulizing plant, where manganese concentrate derived from the ore mined at the Three Kids mine, Las Vegas district, Clark County, and mill tailing shipped from the Candalaria district, Mineral County, by L. D. Foreman & Co. were treated.

Manganese.—Nevada output of manganese ore and concentrate increased markedly in 1954 as a result of uninterrupted production from Manganese, Inc., Three Kids mine and concentrator in the Las Vegas district, Clark County. Combined Metals Reduction Co.

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shipped ore and concentrate from the Castleton mine and flotation mill, Lincoln County, to Pioche Manganese Co., an affiliate. The latter company prepared manganese nodules at Pioche and smelted nodules and some ore at its Henderson ferromanganese plant. The yield from Combined Metals Reduction Co. declined considerably in 1954, however, as manganese-ore production was closely associated with the lead-zinc ores, the output of which was adversely affected by low prices during the year. Western Electrochemical Co. produced synthetic battery ore at Henderson predominantly from foreign ore, but some ores and concentrates from Nevada and Utah sources were also used. Sporadic shipments to Government stockpiles were made by several operators in the State.

A total of 25 mines in 7 counties contributed to Nevada manganese production. Of this, 97,934 short tons of manganese ore and concentrate averaging 46.6 percent manganese and 14,396 short tons of manganiferous ore and concentrate averaging 19.0 percent manganese were shipped to consumers. Government low-grade stockpiles were the depositories of 872 short tons of manganese ore, which averaged 42.0 percent manganese and 1,187 short tons of manganiferous ore, averaging 29.2 percent manganese. Since this low-grade material is blended and stored pending its conversion to a usable product, the value is not included in the State total.

Mercury.—Production of mercury rose abrupty to 53 percent in quantity and 109 percent in value over 1953. Nevada continued to rank second in the Nation, following California. This production increase reflected the average price rise from $193.03 in 1953 to $264.39 per flask in 1954. Humboldt County was the principal source of Nevada mercury by virtue of the output from the Cordero Mining Co. Cordero mine in the McDermitt district. This property was the second largest producer in the United States in 1954. Relatively small shipments of mercury were made from Nye, Pershing, Mineral, Esmeralda, Elko, and Lander Counties.

TABLE 14.—Mercury production by methods of recovery 1945–49 (average) and 1950–54

Year	Direct furnaced		Retorted		Unclassified [1]	Total		Operating mines
	Ore (short tons)	Flasks (76-pounds)	Ore (short) tons)	Flasks (76 pounds)	Flasks (76 pounds)	Flasks (76 pounds)	Value [2]	
1945–49—(average)	18,382	3,597	250	35	----------	3,632	$356,481	7
1950	40,186	5,525	382	72	6	680	55,257	1
1951						1,400	294,182	12
1952						3,523	701,429	9
1953	55,403	7,968	2,006	258	2	3,254	628,120	12
1954						4,974	1,315,076	21

[1] Includes mercury recovered from miscellaneous dump material.
[2] Value calculated at average price at New York.

Molybdenum.—Molybdenum concentrate was recovered as a by-product at the McGill concentrator from Kennecott Copper Corp. Nevada Mines Division and Consolidated Coppermines Corp. porphyry-copper ore. The 1954 shipments of molybdenum concentrate decreased 11 percent from 1953.

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Nickel.—Hogle Bros. explored the Niganz nickel-manganese prospect in the Fish Creek district, Eureka County, but no ore was shipped.

Silver.—Reduction in output of lead and zinc was reflected in the decreased production of silver in 1954, as these base-metal ores have been the chief source of Nevada silver since the decline of precious-metal-ore mining. Silver output fell 20 percent compared with 1953. Base-metal ores and other materials contributed 70 percent of the total silver produced in 1954, whereas straight silver ores and silver-mine tailing were the source of only 24 percent.

A large percentage of the production was from lead-zinc and manganese ores treated at the Combined Metals Reduction Co. Caselton mine, Pioche district, Lincoln County. Other important silver producers were Consolidated Eureka Mining Co., Eureka district, Eureka County (lead ore); J. F. Ala and L. Daz, Delno mine, Delano district, Elko County (lead ore); Kennecott Copper Corp., Nevada Mines Division and Consolidated Coppermines Corp., Robinson district, White Pine County (copper ore); and Summit King Mines, Ltd., Special Account, Tonopah district, Nye County (silver ore). These six principal producers contributed 58 percent of the State's total silver in 1954.

Titanium.—Although data on Nevada's titanium-sponge production are not available for publication, it was an important contribution to the Nation's commercial titanium-sponge output of 5,370 short tons in 1954. In 1953 United States production was 2,241 short tons.

Titanium-sponge-metal production at the Henderson plant of Titanium Metals Corp. of America reached the capacity of its expanded facilities in 1954. Using the same method, reduction of titanium tetrachloride with magnesium, the Bureau of Mines also produced titanium at its Boulder City experimental station. This was done under DMPA contract DMP–76. The titanium tetrachloride was prepared principally outside the State from imported rutile.

The Bureau of Mines also did research at this station on the use of sodium as a reducing agent for titanic chloride and the electrorefining of titanium.

Tungsten.—Nevada continued to lead the Nation in output of tungsten concentrate, with an appreciable increase in production over the previous year. Virtually all production was scheelite concentrate; however, some hübnerite was shipped from White Pine County.

Five producers in four counties contributed nearly 80 percent of all units shipped. Actually, 240 operators in 14 counties provided Nevada's total. The leading producers were Getchell Mine, Inc., and United States Vanadium Co., operating in the Potosi district, Humboldt County; Wah Chang Corp., with operations in the Tem Piute district, Lincoln County; Nevada Scheelite Division of Kennametal, Inc., in the Rawhide district, Mineral County; and the Nevada Massachusetts Co., operating in the Mill City district, Pershing County.

A number of custom mills treated ores from widely scattered operations throughout the State and, in a few cases, upgraded concentrates. Low-grade flotation concentrate was shipped to plants in California, Utah, and New York for treatment by chemical methods.

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TABLE 15—A.—Tungsten concentrate produced from ores in 1954, by counties

County	Producing mines and prospects	Ore [1]			Concentrates produced (pounds)	Contained WO_3 units
		Mined (short tons)	To mills (short tons)	Milled [2] (short tons)		
Churchill	10	1,351	1,351	389	35,853	1,177
Clark	1	[3]	[3]	[3]	[3]	[3]
Douglas	10	6,659	6,659	7,359	76,122	2,409
Elko	15	2,627	2,627	1,439	73,992	2,360
Esmeralda	6	325	325	17,203	192,529	4,293
Humboldt	12	312,402	312,402	315,213	[4] 2,890,941	[4] 96,781
Lander	7	959	897	152	12,962	411
Lincoln	2	[3]	[3]	[3]	[3]	[3]
Lyon	8	529	529	364	11,502	388
Mineral	37	69,962	[5] 85,750	[5] 69,383	1,281,131	45,607
Nye	39	28,327	29,219	30,125	1,076,614	35,136
Pershing	34	223,877	232,734	229,560	1,888,804	68,289
Washoe	6	251	251	89	5,674	183
White Pine	35	13,884	[5] 13,345	[5] 6,241	456,521	14,683
Undistributed		175,572	173,678	171,844	1,773,002	55,408
Total	222	836,725	859,767	849,361	9,775,647	327,125

[1] Partly estimated.
[2] Ore actually milled in county, including material from other counties and States.
[3] Included with "Undistributed" to avoid disclosure of individual output.
[4] Includes concentrate from low-grade tonnage subsequently shipped to California mills for final treatment.
[5] Includes small quantities of tailing and dump ore.

B.—Production and shipments of tungsten concentrate in 1954 credited to Nevada counties in which ore was mined

County	Concentrates				
	Produced [1]		Shipped		
	Pounds	Units	Pounds	Contained WO_3 units	Value [2]
Churchill	35,853	1,177	35,853	1,177	$73,774
Clark	[3]	[3]	[1]	[1]	[1]
Douglas	76,122	2,409	76,122	2,409	150,996
Elko	73,992	2,360	73,992	2,360	147,925
Esmeralda	2,801	93	2,801	93	5,829
Humboldt	2,890,941	96,781	2,890,941	96,781	6,066,238
Lander	12,962	411	12,962	411	25,761
Lincoln	[3]	[3]	[1]	[1]	[1]
Lyon	11,502	388	11,502	388	24,320
Mineral	1,470,859	49,807	1,470,859	49,807	3,121,903
Nye	1,076,614	35,136	1,076,614	35,136	2,202,324
Pershing	1,888,804	68,289	1,867,104	67,512	4,231,652
Washoe	5,674	183	5,674	183	11,471
White Pine	456,521	14,683	456,521	14,683	920,330
Undistributed	1,773,002	55,408	1,557,002	48,914	3,065,930
Total	9,775,647	327,125	9,537,947	319,854	20,048,448

[1] Partly estimated.
[2] Value of $62.68 per unit based on average of GSA purchases.
[3] Included with "Undistributed."

Uranium.—Prospecting for uranium continued in virtually all sections of Nevada in 1954, and shipments of low-grade uranium ore were made from the Kings River area of Humboldt County. Data on production of uranium in the State are not available for publication.

Zinc.—Zinc output fell 82 percent in quantity and 83 percent in

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value from 1953 production, owing primarily to lowered output of zinc concentrate from lead-zinc and manganese ores in 1954 by Combined Metals Reduction Co., the State's leading producer. Only one mine in the State produced straight zinc ore for direct smelting. Some zinc in other materials, primarily lead-zinc and lead ores and silver tailing shipped from various districts in the State, was recovered at lead smelters equipped with fuming plants.

SECONDARY-METALS CONSUMPTION

Iron and Steel Scrap.—Leaching copper ore by Anaconda Copper Mining Co. at Yerington, Lyon County, consumed about 1.25 pounds of ferrous scrap in the form of light-gage sheet steel (detinned cans) for each pound of cement copper precipitated; this sizable scrap requirement was filled largely by California shippers. Scrap iron was used in producing cement copper from mine water in White Pine County.

NONMETALS

Barite.—Crude barite output rose to 100,448 tons in 1954, and 83,833 tons was sold or used by producers. Stocks on hand increased 16,615 tons owing to a slowdown of oil-well drilling in California. In 1953, 98,526 tons was produced, and 99,525 tons was sold or used. Lander and Elko Counties together supplied a large percentage of the State yield; a small tonnage was produced in Mineral County. Virtually all the crude barite was shipped to California grinding plants. Magnet Cove Barium Co. continued milling operations at Beowawe and planned to construct a similar plant at Battle Mountain. Most of the Nevada barite, after crushing and grinding, is utilized in drilling mud, chemicals, paints, and glass.

Brucite.—Basic Refractories, Inc., operating in Nye County, was the only producer of brucite in Nevada. The crude material was utilized in combination with dolomite for producing dead-burned magnesia at the company Ohio plant.

Clay.—Owing to a competitive market from California and to the fact that the producers were also the users, clay production was only half of that in the previous year. Fire clay, for pressed brick, and furnace mortar were the two active industries.

Diatomite.—Nevada diatomite sold or used increased 6 percent in quantity and 18 percent in value compared with 1953. Churchill, Esmeralda, and Storey Counties supplied the 1954 output, which was utilized as fillers, abrasives, and in miscellaneous materials, including poultry feed, fertilizer, paper, lightweight aggregate, insulation, paint, and insecticides.

Fluorspar.—Nevada's 1954 fluorspar production came from Churchill, Mineral, Nye, and Pershing Counties; production was 13 percent less than in 1953. Most of the crude output was treated at the Kaiser Aluminum & Chemical Corp. flotation concentrator near Fallon. Acid-grade concentrate was shipped to a chemical plant at Nichols, Calif., for conversion into aluminum fluoride, used in Kaiser Aluminum & Chemical Corp. aluminum-reduction works potlines. J. Irving Crowell continued to supply Pacific coast plants with metallurgical-grade fluorspar from his Nye County property.

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Gem Stones.—Gem-stones output was about the same as in 1953. Turquois from Esmeralda, Mineral, and Lander Counties represented over two-thirds of the value of gem-stones production. Ray Jepperson and Glen Johnson reported a rich strike of turquois at the Turquois Queen mine near Battle Mountain.

Gypsum.—Crude gypsum was produced in Clark, Mineral, and Pershing Counties in 1954. Output was down 7 percent in quantity and up 12 percent in value compared with 1953. A large percentage of this material was calcined, and some was utilized for wallboard at Nevada plants. The remainder was shipped to California, where it was used principally in portland cement and in various building materials.

TABLE 16.—Crude gypsum mined, 1945–49 (average) and 1950–54

Year	Active mines	Production (short tons)	Value
1945–49 (average)	5	480,050	$1,168,643
1950	4	604,604	1,614,107
1951	5	643,637	1,811,757
1952	4	608,284	1,666,938
1953	4	701,584	1,975,053
1954	4	654,422	2,217,273

Lime.—Lime production in 1954 was virtually the same as in 1953, both in quantity and value. Demand in building and chemical markets was up, but owing to the 90-day strike at iron and steel plants, this industry's demand was down. United States Lime Products Corp. produced quicklime and hydrated lime from Clark County limestone; and Kennecott Copper Corp., Nevada Mines Division, prepared quicklime, using limestone from White Pine County, for its McGill Copper-smelting operation.

Magnesite.—Magnesite mined in Nye County by Basic Refractories, Inc., and the Standard Slag Co. was treated to produce caustic-calcined magnesia, magnesium oxychloride, and refractory magnesia. Output in 1954 was 31 percent lower than in 1953 due to lessened demand by the steel industries.

Marl, Calcareous.—Calcareous marl production from the northwest shore of Pyramid Lake in Washoe County increased moderately in quantity and value in 1954. A crushing plant was operated by Double Check Products Co. The material was used as an ingredient in poultry, dairy, and livestock feed manufacture and for soil aid.

Perlite.—Crude-perlite production decreased 38 percent from 1953 to 1954. Lincoln and Pershing Counties were the chief producers of perlite, and a small output was reported from Clark County. A large percentage of Nevada crude perlite is crushed, sized, and shipped out of the State for expanding. Expanded perlite for local consumption was produced in plants operated in Washoe and Clark Counties.

Pumice and Pumicite.—Small tonnages of pumice and pumicite were produced in Churchill, Mineral, and Nye Counties. This material, all assigned for local lightweight-concrete-aggregate use, increased in unit value 500 percent during 1954.

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Salt.—One operation, in Churchill County, reported the production of salt in 1954. State output was virtually the same as in 1953. The salt, recovered from a dry lake bed by surface mining was principally used locally for hide curing, livestock, and de-icing highways.

Sand and gravel.—More than double the previous year's output of sand and gravel was produced in Nevada in 1954. Expanded industrial and housing programs within the State were largely responsible for this increase. The sand deposits worked in Clark County were the most important commercially, yielding industrial sand used largely by the glass, foundry, paving, and structural industries. Other deposits of sand were worked at convenient locations in the State to furnish materials for building, road construction, and railroad ballast.

TABLE 17.—Sand and gravel sold or used by producers 1953–54, by classes of operations and uses

	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERICAL OPERATIONS						
Sand:						
Glass	(1)	(1)	(1)	(1)	(1)	(1)
Molding	79,876	$191,897	$2.40	47,420	$122,753	$2.59
Building	161,059	237,672	1.48	343,716	519,310	1.51
Paving				(1)	(1)	(1)
Other	(1)	(1)	(1)	(1)	(1)	(1)
Gravel:						
Building	148,345	222,001	1.50	384,400	574,959	1.50
Paving	1,269	2,610	2.06	150,927	102,657	.68
Railroad ballast						
Other				15,000	12,300	.82
Undistributed sand and gravel [1]	143,036	460,187	3.22	154,661	567,320	3.67
Total commercial sand and gravel	533,585	1,114,367	2.09	1,096,124	1,899,299	1.73
GOVERNMENT-AND-CONTRACTOR OPERATIONS [2]						
Sand:						
Building				100	50	.50
Paving	21,160	5,598	.26	13,513	6,834	.51
Total Government-and-contractor sand	21,160	5,598	.26	13,613	6,884	.51
Gravel:						
Building				2,000	1,500	.75
Paving	1,711,319	968,983	.57	2,419,554	1,048,854	.43
Total Government-and contractor gravel	1,711,319	968,983	.57	2,421,554	1,050,354	.43
Total Government-and-contractor sand and gravel	1,732,479	974,581	.56	2,435,167	1,057,238	.43
ALL OPERATIONS						
Sand	373,456	841,506	2.25	559,410	1,216,267	2.17
Gravel	1,892,608	1,247,442	.66	2,971,881	1,740,270	.59
Grand total	2,266,064	2,088,948	.92	3,531,291	2,956,537	.84

[1] Included with "Undistributed" to prevent disclosure of individual output.
[2] Includes figures for State, counties, municipalities, and other Government agencies.

Stone.—Nevada stone production was increased sharply in quantity and moderately in value over the previous year. The greatest increase was in basalt, which was crushed in Washoe County for commercial aggregate, and noncommercial miscellaneous stone produced

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in Clark, Elko, Eureka, Humboldt, Mineral, Ormsby, and Washoe Counties. The tonnage of dimension sandstone quarried in Clark and Humboldt Counties increased 13 percent over 1953. Crushed sandstone from Clark and Lincoln Counties was used for roofing granules and ganister. Crushed-limestone output decreased 17 percent in quantity and 9 percent in value in 1954 owing in part to slackened demand at metallurgical plants.

TABLE 18.—Stone, commercial and noncommercial, sold or used by producers in 1953–54, by uses [1]

Use	1953		1954	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone:				
Sawed stone and cut blocks, cubic feet	29,133	$64,372	62,480	$90,101
Approximate equivalent in short tons	2,253		3,124	
Flagging, cubic feet	6,494	10,000		
Approximate equivalent in short tons	500			
Total dimension stone (quantities approximate, in short tons)	2,753	74,372	3,124	90,101
Crushed and broken stone, short tons	1,032,815	1,325,157	1,829,657	1,920,491
Grand total (quantities approximate, in short tons)	1,035,568	1,399,529	1,832,781	2,010,592

[1] Includes basalt, granite, limestone, marble, sandstone, and miscellaneous stone.

Sulfur.—In 1954 no production of sulfur was reported in Nevada. Continental Sulfur & Phosphate Corp. of Dallas, Tex., began testing operations at Sulphur, Nev., to determine the feasibility of constructing a plant for refining sulfur from Humboldt County.

Talc and Soapstone.—The tonnage of talc and soapstone sold and used in Nevada in 1954 decreased 46 percent. The output was shipped to grinding plants in California from Esmeralda County mines.

Volcanic Cinder.—Volcanic cinders were quarried in Nye County for concrete aggregate, principally in building blocks. The quantity and value of 1954 production, which declined 12 percent compared with 1953, are included with pumice and pumicite in the State totals.

MINERAL FUELS

Interest in Nevada as a potential oil-producing State was intensified by the discovery of petroleum in commercial quantities by the Shell Oil Co. in Railroad Valley, Nye County, and by Gulf Refining Co.'s discovery of a noncommercial oil-bearing strata in Elko County.

The 1954 production of crude petroleum, all from Nye County, was the first recorded in the State. The first well was completed in June by the Shell Oil Co. on the Grant State Game Refuge a few miles south of Callaway. Although planned initial representative production was 373 barrels a day, total production for the remainder of the year only averaged about 5,500 barrels a month. The productive zone was composed of rhyolitic tuffs of Tertiary age. A program of stratigraphic study in nearby mountain ranges and seismic shooting in Railroad Valley itself preceded the discovery. Approximately 6

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months separated the end of shooting in the area and the spudding of the well. The initial well was drilled for stratigraphic information and to test a seismic prospect.

REVIEW BY COUNTIES

Churchill.—Aquafil Co. mined diatomaceous earth at the Chick Bed open-pit mine 22 miles northeast of Fernley and shipped it to its mill at Fernley, Lyon County, for processing. Kaiser Aluminum & Chemical Corp. produced acid-grade fluorspar at the company 100 ton-a-day flotation mill 1 mile west of Fallon. Crude ore for the fluorspar mill was supplied by the company Kaiser mine in Mineral County and custom shippers in Churchill, Lander, Nye, and Pershing Counties. Fallon Concrete Products Co. utilized pumice from its claim 20 miles east of Fallon at its Fallon concrete-block plant. The Nevada Highway Department and its contractors produced sand and gravel at various locations in the county for highway construction.

Alpine (Clan Alpine) District.—Tungsten Mountain Mining Co. shipped tungsten ore to a custom mill from the Hilltop (Tungsten Mountain) mine. A DMEA project was also initiated on this property in 1954.

Buena Vista District.—Mineral Materials Co. shipped magnetite ore containing 57 percent iron from the Buena Vista mine for export.

Eastgate District.—L. P. Burch amalgamated gold ore from the Gold Ledge group of claims and recovered gold and silver.

TABLE 19.—Value of mineral production in Nevada, 1953–54, by counties

County	1953	1954	Minerals produced in 1954, in order of value
Churchill	$158,357	$497,607	Diatomite, sand and gravel, tungsten concentrate, iron ore, fluorspar, silver, pumice, lead, salt, gold, zinc.
Clark	[1] 6,669,485	12,497,511	Manganese ore, lime, sand and gravel, gypsum, stone, lead, perlite, copper, gold, tungsten concentrate, silver.
Douglas	278,117	221,043	Tungsten concentrate, iron ore, sand and gravel.
Elko	761,968	599,007	Tungsten concentrate, barite, lead, sand and gravel, silver, copper, zinc, stone, gold, mercury.
Esmeralda	463,206	[1] 453,879	Diatomite, talc and soapstone, tungsten concentrate, mercury, sand and gravel, gold, silver.
Eureka	[1] 297,234	[1] 454,591	Lead, sand and gravel, stone, silver, gold, zinc, copper.
Humboldt	6,440,045	[1] 7,818,859	Tungsten concentrate, mercury, iron ore, stone, sand and gravel, gold, copper, silver, lead.
Lander	[1] 1,779,522	[1] 1,813,364	Gold, barite, sand and gravel, copper, tungsten concentrate, silver, mercury, lead.
Lincoln	[1] 4,494,790	[1] 4,497,214	Tungsten concentrate, lead, perlite, manganese ore, zinc, manganiferous ore, silver, gold, sand and gravel, copper, stone.
Lyon	551,477	15,474,726	Copper, sand and gravel, tungsten concentrate, gold, silver.
Mineral	2,851,010	4,076,176	Tungsten concentrate, fluorspar, lead, sand and gravel, silver, stone, gold, zinc, mercury, gypsum, copper, barite, pumice.
Nye	2,789,125	2,912,217	Tungsten concentrate, magnesite, fluorspar, volcanic cinders, petroleum, silver, gold, iron ore, mercury, sand and gravel, brucite, lead, antimony, copper, zinc.
Ormsby	2,378	27,348	Sand and gravel, gold, stone, silver.
Pershing	[1] 6,105,054	6,695,720	Tungsten concentrate, iron ore, gypsum, perlite, mercury, fluorspar, sand and gravel, gold, silver.
Storey	857,749	933,399	Diatomite, gold, silver, sand and gravel.
Washoe	630,728	1,061,508	Sand and gravel, stone, marl, tungsten concentrate, clays, gold, lead, copper, silver, zinc.
White Pine	[1] 38,323,102	[1] 29,038,687	Copper, gold, tungsten concentrate, lime, molybdenum, stone, sand and gravel, silver, manganese ore, lead, clay.
Undistributed	69,630	65,293	Gem stones, sand and gravel, mercury.
Total	73,523,000	89,138,000	

[1] Excludes value of manganese and manganiferous ores sold and blended at Government low-grade stockpiles for future beneficiation.

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Fairview District.—Roy Durbin et al. shipped a small quantity of lead ore containing silver and zinc to a California smelter-fuming plant from the Chalk Mountain mine.

Holy Cross District.—Clark C. Shaw shipped lead concentrate containing gold and silver derived from 54 tons of gold ore to a California smelter from the Camp Terrell group of claims. H. M. Erb and G. W. Goff produced silver concentrate from silver ore mined at the Pyramid mine. The concentrate which also contained gold, lead, and zinc, was shipped to a California lead smelter-fuming plant.

Rawhide District.—A Nevada custom mill treated a small tonnage of tungsten ore from the Snow Flower group of claims near the Mineral County line operated by R. G. Johnson.

Sand Springs District.—Al Derrick hand-sorted and shipped to a custom mill approximately 1 ton of tungsten ore from the Corona mine. Churchill Tungsten Mining Co. mined and milled tungsten ore from the Red Ant group of claims. The Leslie Salt Co. produced a small tonnage of salt (sodium chloride) from the Fallon Development Co. deposits by surface mining.

Clark.—Nu-Lite Insulated Homes, Inc., and Searchlight Insulation Products Co. quarried perlite in the Castle Mountains west of Searchlight. The material was expanded at their plant in Fontana, Calif. The National Park Service and the Nevada Highway Department and its contractors produced sand, gravel, and crushed miscellaneous stone at several localities in the county for highway construction.

Apex District.—United States Lime Products Corp. operated the Apex limestone quarry and crushing plant 18 miles north of Las Vegas.

Arden (Blue Diamond) District.—Blue Diamond Corp. worked its open pit and underground gypsum mine 28 miles southwest of Las Vegas. The company calcined gypsum and operated a plaster mill and gypsum lath and board plant near the mine. Cind-R-Lite, Inc., manufactured building blocks 9 miles southwest of Las Vegas, using Nye County volcanic cinders for aggregate.

Bunkerville District.—Tri-State metal shipped tungsten concentrate from the Silver Leaf mine to an ore buyer.

Charleston Mountains District.—J. H. Caldwell et al. shipped 9 tons of lead ore containing 6,250 pounds of lead and 9 ounces of silver to a Utah smelter from the J & S group of claims.

Eldorado Canyon District.—Joseph Horn shipped a small quantity of gold and silver amalgam from a cleanup of the Wall Street mine.

Gold Butte District.—A small tonnage of copper ore, containing some gold and silver, was shipped from the Lakeside mine operated by R. E. Perkins to McGill, White Pine County, for smelting.

Goodsprings (Yellow Pine) District.—C. A. R. Copper Mines, operating the C. A. R. mine, shipped copper ore containing silver and zinc to a Utah smelter. Nevada Flagstone Quarries, Inc., near Goodsprings quarried rough architectural dimension sandstone.

Las Vegas-Boulder City District.—Manganese, Inc., contracted for manganiferous ore mining at the Three Kids mine, 6 miles east of Henderson, and treated the ore at the company Henderson concentrator-nodulizing plant. The manganese nodules produced were ultimately assigned to a Government stockpile. This company, the

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largest producer of manganese materials in the State, also shipped to a Utah smelter an appreciable quantity of lead residue, containing some gold, silver, and copper, which was recovered as dust from the calcining furnace at the manganese concentrator. The mine and plant operations were described in a trade journal.[3] Western Electrochemical Co. produced synthetic battery ore at its Henderson plant, principally from foreign manganese ores. Pioche Manganese Co., a subsidiary of Combined Metals Reduction Co., operated a ferromanganese plant at Henderson and utilized both foreign manganese ore and manganiferous ore and concentrate from Lincoln County sources. The smelter operation was described in an article.[4] Titanium Metals Corp. of America produced titanium sponge at its enlarged facilities in Henderson. The Bureau of Mines produced the sponge metal at its experimental plant at Boulder City until September 7, 1954, under DMPA contract DMP–76. United States Lime Products Corp. produced quicklime and hydrated lime at its plant near Henderson from limestone quarried in the county. Las Vegas Building Materials at Whitney and Stewart & Hitchcock, Young & Smith Construction Co., and Stocks Mill & Supply Co. at Las Vegas produced structural sand and gravel. Stauffer Chemical Co. prepared chlorine, utilizing California salt, at Henderson. Pabco Products, Inc., operated the White Eagle pit company mill 8 miles north of Henderson. The gypsum produced was shipped largely to the company California hardboard plant.

Overton District.—Molding sand was produced by Fred Morledge at the Red Gorge mine 4 miles west of Logandale and the Moapa Placer claim, 2 miles south of Overton. Snoreen & Son operated a sand pit 4 miles south of Overton and shipped molding sand. Glass sand was produced at the Nunn Co. pit and mill 6 miles southwest and 1½ miles south of Overton. Nevada Silica Sands, Inc., produced a variety of industrial sands at its pit and plant 7 miles south and 1 mile west of Overton.

Searchlight District.—Jack Givens shipped a small quantity of gold ore containing silver to a Utah lead smelter from the Givens Metals prospect.

Douglas.—*Buckskin District.*—The Standard Slag Co. consigned for export magnetite ore containing 60 percent iron from the Minnesota open-pit mine.

Gardnerville District.—C. B. Lovestedt shipped tungsten ore and concentrate to a custom mill from the Cherokee open-pit mine, the Hopi, the Divide & Snowbird underground mines, and the Garrett lease. Metallurgical Development Co. mined and milled tungsten ore from the Owl mine besides custom-milling other local tungsten ores. Albert Geddes shipped tungsten ore and concentrate to a custom mill from the Albert Geddes mine.

Mountain House District.—Yamate Trading Co. and Wm. Hooper operated the Empire mine and Topaz mine, respectively. Tungsten ore and concentrate from both properties were shipped to a custom mill.

Elko.—Baroid Sales Division, National Lead Co., shipped barite from the Rossi open-pit mine 55 miles northeast of Battle Mountain to its grinding plant at Merced, Calif. The Elko County Highway

[3] Mining World, vol. 16 No. 7, June 1954, pp. 46–55.
[4] Mining World, vol. 16 No. 6, May 1954, pp. 39–41.

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Department and the Nevada Highway Department and its contractors prepared sand and gravel at several locations for highway construction.

Alder District.—Knowles Bros. (Garnet Tungsten Mining Co.) planned to continue the DMEA exploration contract originally held by Sunshine Mining Co. on the Garnet No. 1 and No. 2 tungsten property. Sunshine Mining Co. diamond-drilled the formation before relinquishing its interest.

Contact District.—Marshall Mining Co. and its successor, American Western Exploration Co., together shipped 1,784 tons of copper ore to a Utah smelter from the Marshall (Nevada-Bellvue) mine. The gross metal content of the ore was 20 ounces of gold, 2,219 ounces of silver, and 115,783 pounds of copper. A DMEA contract continued in effect in 1954, and the work consisted principally of drifting and crosscutting.

Delano District.—Gold ore containing silver and lead was shipped to a Utah copper smelter from the Comeback mine by J. R. and R. L. Wilson. Lead ore from the Delno mine operated by J. F. Ala & L. Daz, was shipped to a California smelter-fuming plant. The ore contained substantial quantities of silver and zinc but relatively small quantities of gold and silver.

Island Mountain District.—Diamond Jim Mining Co. shipped lead ore, containing appreciable silver and lesser quantities of gold and copper, from the Diamond Jim group to a Utah smelter.

Ivanhoe District.—C. G. Staggs and A. J. Quilici retorted a small quantity of mercury from ore produced at the Staggs & Quilici property.

Jarbridge District.—White Star Tungsten Mines shipped tungsten concentrate to an ore buyer from the Batholith underground and open-pit mine.

Loray District.—A test shipment of lead ore to a smelter was made by the Silver Ace Mining & Milling Co. from the Lost Hope group of claims. Small quantities of silver and zinc were contained in the ore.

Merrimac District.—During cleanup operations at the Rip Van Winkle property, J. D. Carter, shipped small quantities of lead-zinc ore to a Utah custom mill for treatment. A small tonnage of lead tailings was consigned to a smelter. United Minerals Corp. continued to hold a DMEA contract on the Rip Van Winkle lead-zinc mine, but no work was done during the year. Hogle Bros. shipped a small tonnage of tungsten ore to a custom mill from the Lone Mountain claim.

Mountain City (Cope) District.—Hugh C. Bieroth shipped copper tailings containing silver, which originated at the Rio Tinto mine, to a Utah smelter. Ralph Williams recovered gold and silver from the Best Chance placer-mine stream gravels by small-scale hand methods.

Railroad (Bullion) District.—John Uhalde, lessee, operated the Aladdin mine and shipped lead ore, containing gold, silver, copper, and zinc, to a California smelter-fuming plant for treatment.

Rock Creek District.—Louis Salet worked the Tea Pot-Boston mine, an open pit and underground mercury operation, and retorted a small quantity of mercury.

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Ruby Range District.—The Little Four Mining Co., operating the Knob Hill (Long Canyon) mine, shipped lead concentrate derived from lead ore to a Utah smelter. The concentrate also contained small quantities of gold, silver, and copper. Jake M. Burner developed the Manganese Mountain No. 2 property for manganese ore. Max Irwin developed the Battle Creek claim and shipped tungsten ore to a custom mill. D. C. Purdie shipped tungsten ore from the same property. E. F. Ritchie and Felix Fong shipped a small tonnage of tungsten ore to a custom mill from the Lakeview underground mine.

Ruby Valley District.—Tungsten ore was shipped to custom mills by the following operators (mines in parentheses): James Stinnett (Climax); G. F. Ogilvie, A. F. Francis, and Lowell Thompson (Star); and G. A. Latham, W. C. Lage, and L. A. Olson (Stormy Night).

Tecoma District.—James M. Young shipped lead ore containing gold, silver, and zinc to a California smelter-fuming plant from the Jackson group of claims.

Esmeralda.—The Nevada Highway Department produced gravel for road construction at various locations in the county.

Columbus Marsh District.—Argentum Mining Co. of Nevada operated a flotation mill in conjunction with its Northern Belle-Holmes silver mine near Candelaria, Mineral County.

Fish Lake Valley District.—Mercury was recovered at the Red Rock mine by W. F. Dunnigan. Exploration under a DMEA contract continued at the property. Archy Brady shipped talc from the White King mine, and A. A. Goehring produced talc at the C. C. mine. The material was ground at southern California mills.

Goldfield District.—James Reid developed the Joan of Arc underground manganese mine and hand-cobbed a small quantity of ore for shipment to a Government stockpile.

Hornsilver District.—Harry Wiley and M. J. Huson recovered gold and silver during cleanup operations at the State Line mill.

Lone Mountain District.—The American Gem Co. reported a production of 2,900 pounds of turquoise valued at $43,500 from the Lone Mountain mine.

Miller Mountain District.—Great Lakes Carbon Corp., Dicalite Division, operated its open-pit mine and mill, 3 miles east of Basalt near the Mineral County line and produced diatomaceous earth.

Palmetto District.—Cucamunda Scheelite, Inc., shipped tungsten concentrate derived from Green Top mine ore to a buyer. A. L. Hildebrand sampled the Stinger tungsten claim. H. N. Stewart shipped talc from the Hideout No. 1 (Gates) open-pit mine to a southern California grinding plant.

Pilot Mountain District.—Lindsay Mining Co. operated a tungsten-concentrating mill in conjunction with its Lindsay mine, nearby in Mineral County.

Silver Peak District.—John Gobert shipped a small quantity of gold-silver tailing to a smelter from the Silver Peak Valcalda mine. James Bias developed the Two Deuces mine and shipped a small tonnage of tungsten ore to a custom mill.

Sylvania District.—Don H. Clair milled tungsten ore from the Four Aces (Sylvania) mine and shipped the concentrate to ore buyers. Some custom ore was also treated at the mill. Sierra Talc & Clay

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Co. operated the Oasis mine, and Huntley Industrial Minerals, Inc., worked the Sundown mine near Oasis, Calif. Talc from both properties was ground in southern California. H. N. Stewart shipped soapstone from the Lone Springs mine to a southern California grinding plant.

Tokop District.—Vivian Mining Co. shipped tungsten ore to a custom mill from the Copper King mine.

Eureka.—Magnet Cove Barium Co. operated a mill at Beowawe and ground crude barite quarried in Lander County for that company.

Cortez District.—Silver tailing containing gold, copper, lead, and zinc was shipped to a California smelter-fuming plant by McFarland & Hullinger from the Cortez mine.

Diamond District.—N. W. Keller and D. L. Pruitt made a small shipment of lead slag to a smelter from the Philipsburg mine. Small quantities of silver and copper were contained in the slag.

Eureka District.—Consolidated Eureka Mining Co. began shipping lead ore to a Utah smelter about midyear from the Consolidated Eureka (Diamond-Excelsior) mine. The ore contained appreciable quantities of gold and silver, and minor values in copper. Exploration continued under a DMEA contract and consisted of drifting and rehabilitating portions of the shaft and drift. Eureka Corp., Ltd., continued exploration and development of the Richmond-Eureka lead-zinc mine by sinking the new T. L. shaft in the Cyanide-Holly-Bullwocker area. Recent activities in the district were described in an article.[5]

Fish Creek District.—Exploratory work by Hogle Bros., consisting of incline shaftsinking, drifting, and crosscutting, progressed on the Niganz nickel-manganese prospect in 1954.

Lynn District.—Paul Clemmons treated old tailing from the Ciopra placer mine, using a nonfloating washing plant, and recovered gold and some silver. Gold of Ophir Placers, Inc., operated a dragline dredge and washing plant on gravel at the Gold of Ophir mine during the latter half of the year and recoverd gold and silver.

Humboldt.—The Humboldt County Highway Department and the Nevada Highway Department and its contractors produced gravel at various sites for highway construction.

Awakening District.—Consolidated Mines amalgamated Alabama mine gold ore and recovered both gold and silver.

Battle Mountain District.—A small tonnage of copper ore from the Humboldt Copper mine was shipped to a Utah smelter by Jack Susmill. Gold and silver were also contained in the ore.

Bottle Creek District.—Aubrey Minney retorted mercury ore from the McAdoo underground mine and continued exploration under a DMEA contract. Exploration consisted of drifting and sinking a winze. Equipment was destroyed by fire later in the year which curtailed the work.

Dunnashee District.—Fred E. Hummel recovered 4 ounces of gold and 1 ounce of silver from 150 cubic yards of ancient-river-bed gravel at the Last Chance placer mine.

Dutch Flat District.—T. A. Cowan treated some mercury ore produced from the Dutch Flat mine.

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[5] Engineering and Mining Journal, vol. 155, No. 12, December, 1954, p. 80.

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Golconda District.—Valley View mine shipped 14,646 tons of tungsten ore, grossing 7,659 units of WO_3, to a custom mill from the Valley View open-pit mine. A gasoline power shovel and a diesel scraper loader were used in the operation.

Gold Run District.—Maurice W. Oyler recovered a small quantity of gold from the Hidden (Ontario) placer-mine stream gravel by small-scale hand methods.

Jackson Creek (Jungo) District.—Taylor & Williams, contractors for A. & B. Mining Co., shipped magnetite ore from the Iron King (DeLong) open-pit mine to eastern steel furnaces.

King's River District.—Platora Uranium Corp. initiated an exploration contract under DMEA for the Moonlight uranium mine. Initial work, which began in the latter part of the year, consisted principally of drifting along the hanging wall of the Moonlight fissures. Uranium ore was reported shipped from the area.

McDermitt (Opalite) District.—Mercury ore was furnaced at the Cordero underground-open-pit mine by the Cordero Mining Co., the second largest mercury producer in the United States. The company plant included an 80-ton Herreschoff furnace.

Paradise Valley (Poverty Peak) District.—Modarelli & Galli (Mogul Mining Co.) shipped 75 long dry tons of 45-percent manganese ore to a Government stockpile from the King group of claims. Irving R. Walters mined and retorted 188 tons of mercury ore from the Cahill mine but sold the property in the latter part of 1954. Wyada Construction Co. furnaced a small quantity of mercury ore from the Conchita (Turrillas) open-pit mine.

Potosi District.—Getchell Mine, Inc., operated the Getchell group of open-pit and underground tungsten mines throughout 1954. In terms of recovered WO_3, the operation was the second ranking tungsten producer in the State. Company and custom ore was treated in a flotation mill in conjunction with an acid-leach treatment. Finished concentrate was consigned to Government stockpiles. The mill was described in an article.[6] United States Vanadium Co. operated the Riley open-pit and underground mine under contract to John Etchart, Jr., and shipped tungsten ore to the Getchell mill for upgrading. The low-grade concentrate produced was shipped to the United States Vanadium Co. mill in Bishop, Calif., for final treatment. This mine ranked fifth in the State in 1954, in terms of shipments of recovered WO_3. John Etchart, Jr., also shipped tungsten ore from the Richmond mine to a custom mill. The TNT Lease shipped an appreciable tonnage of tungsten ore to a custom mill from the Mountain King open-pit mine. Arosteguy & Lugea shipped a small tonnage of high-grade tungsten ore to a custom mill from the Sure Shot claim.

Rebel Creek (New Goldfields) District.—A small shipment of lead concentrate from the Ohio mine lead ore was made to a smelter by Andy P. Lauritzen. Some gold and an appreciable quantity of silver were contained in the concentrates.

Varyville (Leonard Creek) District.—A small tonnage of copper ore from the Blue Jack group was shipped to a Utah smelter by the Blue Jack Corp.

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[6] Mining World, vol. 16, No. 1, January 1954, pp. 38–42.

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Virgin Valley District.—Owyhee Stone Co., Inc., prepared dressed sandstone at the Zeb Turner quarry, 32 miles west of Denio.

Warm Springs (Vicksburg) District.—Barnes & Pratt operated the Defense open-pit mine part of 1954 and sold tungsten concentrate to a custom mill. Ore was treated by gravity methods. Lincoln Gold Dredging Co. also treated Defense-mine tungsten ore by gravity methods and shipped the tungsten concentrate produced to a custom mill.

Lander.—Barium Products, Ltd., operated the Mountain Springs open-pit mine and crushing plant, 26 miles south of Battle Mountain and shipped barite to the company grinding plant at Modesto, Calif. Magnet Cove Barium Co. mined barite from the Big Four and Standard claims 35 miles south of Battle Mountain. Most of the barite produced was ground at its Beowawe mill in Eureka County. The Nevada Highway Department produced gravel for miscellaneous highway projects in the county.

Battle Mountain District.—The Natomas Co. worked the Greenan Placers bench gravels by bucketline dredge throughout the year. The company was the second largest producer of gold in the State in 1954; and, according to its annual report to stockholders for the fiscal year ended September 30, 1954, the operation showed an improvement over 1953 production and resulted in a small net profit before depreciation, as compared with a loss in that year. The following operators shipped copper ore to a Utah smelter (the mines are shown in parentheses): J. E. and W. O. Broyles (Billie Day group), Ray Jepperson and Glenn Johnson (Carissa [Copper Basin] and Western Lock [Alexander group]), A. R. Hider (Contention), Emil Balch (Copper Basin), The Copper Canyon Mining Co., et al., (Copper Canyon), M. Coulter (Copper King [Copper Basin]), George A. Hinman (Extension), Jack Stoner and Kimball Elquist (Superior Lease [Copper Canyon group]), and A. G. Miller (Sweet Marie [Copper Basin]). All the copper ore shipped contained small quantities of gold and silver. J. B. Cole et al. consigned gold-silver ore to a smelter from the Independence mine. Copper and lead were also contained in the ore. E. H. Potter shipped manganiferous ore from the Black Rock mine to a Government stockpile.

Birch Creek (Spencer Hot Springs) District.—G. G. Peer mined tungsten ore from the Conquest underground mine and concentrated some at the Sunnyside gravity plant. The remainder was treated at a custom mill. Ryan Oil Co. explored the Lakin (Gold Acres) lease and shipped tungsten ore to a custom mill. Consolidated Uranium Mines, Inc., developed the Linka mine and shipped small tonnages of tungsten ore to a custom mill. Construction of a flotation mill with an acid-leach section was underway throughout 1954.

Bullion District.—The London Extension Mining Co., the largest individual gold producer in the State, cyanided appreciable quantities of gold ore from the Goldacres open-pit mine at its 350-ton-a-day mill. Silver was also recovered. The Independence placer mine bench and stream gravel, worked by Bert Godwin using small-scale hand methods, yielded some gold.

Iowa Canyon District.—Kaiser Aluminum & Chemical Corp. initiated a DMEA contract on the Iowa fluorspar mine and completed the bulldozer-trenching exploration in the last quarter of 1954.

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New Pass District.—A. J. Cooley leased the Thomas W. mine and amalgamated gold ore, containing silver, in a 10-stamp mill. William V. Bush did development work at the Last Chance No. 1 manganese property and hand-sorted a small quantity of manganiferous ore, which was shipped to a Government stockpile.

Reese River District.—Lynch Creek Mining Co. shipped tungsten concentrate from the Lynch Creek mine to an ore buyer.

Wild Horse District.—Melvin McCoy, C. I. Casteel, and F. A. Pedlar worked the Liquid Metals (McCoy) mercury mine. The mined ore was retorted on the property.

Lincoln.—The Nevada Highway Department and its contractors produced gravel at several locations for highway purposes.

Atlanta District.—Atlanta Gold & Uranium Co. shipped 5,993 tons of direct-smelting gold ore, containing silver, from the Atlanta mine to McGill, White Pine County. The property was also explored and developed.

Comet District.—Combined Metals Reduction Co. produced lead and zinc concentrates at the Castleton mill in the Pioche district from lead-zinc ore mined at the Comet Coalition (Pan American) mine. Gold and silver were also recovered from the concentrates shipped to smelters. Exploration continued in 1954 under a DMEA contract as a drift was advanced on one of the mine levels.

Ely Springs (Lone Mountain) District.—Silver ore, containing some gold, was shipped to a smelter from the King Midas (Hedman) mine operated by John A. Hedman. The property was being developed and explored.

Groom District.—Dan Sheahan operated the Groom mine and mill and shipped lead concentrate containing gold, silver, and copper to a Utah smelter.

Jack Rabbit District.—Bristol Silver Mines Co. shipped 2,518 tons of copper-lead-zinc ore and lead-zinc ore to California and Utah smelter-fuming plants from the Bristol mine. The Black Metal Mining Co. Black Metal mine, a joint venture with Combined Metals Reduction Co., mined and shipped manganiferous ore to the latter company's Castleton mill in the Pioche district for concentration. In addition to the manganese in manganese concentrate gold, silver, lead, and zinc were recovered in lead and zinc concentrates produced from the ore. Idamic Mines also shipped a small quantity of manganiferous ore from the Lucky Star group (Idamic) claims to the Castleton crushing plant, and continued exporation under an amended DMEA contract.

Pahranagat (Hiko) District.—The Combined Metals Reduction Co. shipped manganese and manganiferous ores from the South Paw underground mine to a Government stockpile.

Pioche District.—Combined Metals Reduction Co. further curtailed mining and milling activity as compared with 1953. Lead-zinc ore was mined principally from the company Pioche No. 1 and No. 2 mines and from the Raymond Ely West property. Manganiferous ore containing gold, silver, copper, lead, and zinc was also mined from the Pioche No. 1 and No. 2 mines and represented the largest source of manganiferous material in the district. All ore was treated in the company 2,500-ton-a-day-capacity Caselton mill. The mill products, including those from custom ore, were lead concentrate,

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containing gold, silver, copper, and zinc, which was treated at a Utah smelter-fuming plant; zinc concentrate, containing recoverable gold, silver, copper, lead, and cadmium, which was consigned to a Montana zinc smelter; and manganese concentrate, which was nodulized in a kiln at Caselton operated by Pioche Manganese Co., an affiliate of Combined Metals Reduction Co. Raymond-Combined Mines Co. continued crosscut and diamond-drill exploration under a DMEA contract on the various claims in the group. Lessees shipped a small tonnage of silver ore to a smelter from Pioche Mines Consolidated, Inc., Wideawake group of claims. Yuba Dike Mines, Inc., operating the Yuba Dike mine, made a small shipment of gold-silver ore to the McGill, Nev., smelter. Combined Metals Reduction Co. also leased the Prince Consolidated Mining Co. Black Prince mine and milled a small quantity of manganiferous ore from that property. The Pioche Mines Consolidated, Inc., Telephone mine shipped manganiferous ore to a synthetic battery-ore plant at Henderson, Clark County. Combined Metals Reduction Co. produced crude perlite at the Hollinger pit, 17 miles northeast of Pioche and operated the Panacalite perlite-sizing mill at Caselton. The sized material was shipped to various expanding plants in the United States.

Tempiute District.—Wah Chang Mining Corp., third largest producer of tungsten concentrate in Nevada in 1954, operated the Lincoln underground and open-pit mine. Ore was treated in the company gravity and flotation mill. Low-grade concentrate was shipped to a custom mill for further upgrading, and high-grade concentrate was consigned chiefly to a Government stockpile. Y–Z Mining Co. shipped tungsten ore to a California custom mill from the North Tempiute underground mine. A DMEA exploration loan was also initiated in 1954 and the work consisted of advancing several drifts.

Lyon.—Aquafil Co. operated the Aquafil mill (Raymond mill and drying plant) at Fernley and processed diatomite produced at the Chick Bed mine in Churchill County. The Nevada Highway Department and its contractors produced sand, gravel, and crushed miscellaneous stone at different locations for highway construction.

Silver City District.—O. A. Herbert, operating the Dayton Dredge dragline and stationary washing plant, recovered substantial quantities of gold and silver from ancient riverbed gravels. Steve Brighenti et al. recovered gold and silver by amalgamating the Dayton-mine gold ore. Carson Tungsten Co. milled 237 tons of tungsten ore from the Windy Day underground mine and smaller tonnages from several custom shippers. Ore was treated in a combined gravity and flotation plant, and concentrate was shipped to a buyer. C. W. Neeley shipped tungsten ore from the Tungsten Flats mine to a custom mill.

Yerington District.—Anaconda Copper Mining Co. completed the first full operating year at its new Yerington open-pit mine and leaching plant. This mine was one of the leading producers of copper in the State. Ferrous scrap in the form of detinned cans was used for precipitating the cement copper. The mine and plant operations were described in several articles.[7]

[7] Mining World, vol. 16, No. 8, July 1954, pp. 45–70.
Engineering and Mining Journal, vol. 155, No. 8, August 1954, pp. 72–93.

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Mineral.—Curtis Cline mined a small tonnage of barite from a prospect near Candelaria. C. W. Cooper produced pumice from the Pumco mine near Mina for concrete aggregate. The Nevada Highway Department and its contractors prepared sand, gravel, and crushed stone at various locations for highway construction.

Acme Fitting District.—Rudolph P. Settergren and Duane Wentland recovered gold by amalgamating a small quantity of gold ore from the Past Tense claim. Kinkead Milling Co. operated the Kinkead mill on custom and company tungsten ore produced in neighboring districts.

Broken Hills District.—Kaiser Aluminum & Chemical Corp. trucked fluorspar from the Kaiser (Baxter) mine 19 miles north of Gabbs to the company mill at Fallon.

Candelaria (Belleville) (Columbus) District.—L. D. Foreman & Co. shipped silver tailing containing gold, silver, copper, lead, zinc, and antimony to a California smelter-fuming plant from the Belleville and Columbus dumps. G. A. Peterson and Joe Marinelli operated the New Potosi mine throughout 1954 and shipped 1,321 tons of antimonial-lead ore containing 469 ounces of gold, 14,407 ounces of silver, 216 pounds of copper, 243,265 pounds of lead, 4,100 pounds of zinc, and appreciable quantities of antimony to smelters in California and Utah. Argentum Mining Co. of Nevada operated the Northern Belle-Holmes mine at Candelaria and a flotation mill 8 miles south of Candelaria in Esmeralda County. Silver concentrate containing gold, copper, lead, and zinc was shipped to a California smelter-fuming plant. Candelaria Exploration Co. shipped silver ore, containing gold, to a smelter from the Petrel mine.

Eagleville District.—R. E. Shupe made a small shipment of gold ore containing silver to a smelter from the Rita mine. Willis Barnes shipped a small quantity of tungsten concentrate to a custom mill from the Azurite claim.

Garfield District.—Joe Viani and Lloyd Mount did development work at the Red Dog underground tungsten mine in the early part of 1954.

Hawthorne District.—John E. McFarren shipped lead ore containing silver and zinc to a California smelter-fuming plant from the Lucky Boy mine. W. R. Greenough and H. R. Quick made a small shipment of silver ore from the Silver Star mine to a smelter. Gold ore, containing silver, was shipped to a smelter by A. Burns and G. Walter from the Sitting Bull mine. Ira G. Pellett made a small shipment of lead ore, containing some silver and zinc, to a California smelter-fuming plant from the Wonderhead No. 1 claim. The following operators shipped tungsten material to ore buyers: A. D. Robinson, tungsten concentrates from the Gopher Hole mine ore; John McFarren and W. A. Oliver, tungsten concentrate from ore produced at the Lucky Boy open pit and underground mine; Kinkead Milling Co., tungsten concentrate, derived from the Smokey claim ore; Charles Gillespie, tungsten concentrates from ore which originated at the T. O. G. open-pit operation.

Poinsettia District.—John E. Schlink developed ore at the Poinsettia underground mercury mine, and Joe Stokes mined and retorted ore from the same property.

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Pilot Mountain District.—L. D. Foreman & Co. shipped silver tailing from the Nelson dump at Sodaville to a California smelter-fuming plant. The material also contained gold, copper, lead, zinc, and antimony. R. J. Canavan and L. L. Vastine and H. Sipe worked the Red Top underground mercury mine for part of 1954 and retorted some of the mined ore. Lindsay Mining Co. operated the Gunmetal tungsten mine until the latter part of 1954 and concentrated the ore at the company mill in Esmeralda County. Nevada Tungsten Corp. operated a custom-gravity tungsten mill on local ores and produced scheelite concentrate.

Rawhide (Regent) District.—Audrey Lee Mining Corp. worked the ancient river gravels of the Rawhide placer mine with mechanical equipment in the early part of the year. Gold and silver was recovered. Nevada Scheelite, Division of Kennametal, Inc., operated the Nevada Scheelite (Leonard) mine, fourth in the State output of tungsten concentrates. Ore was treated in the company flotation-gravity mill. The mine produced 41,212 tons of ore averaging about 0.9 percent WO_3. The company also purchased small lots of high-grade tungsten concentrate from local mine operators. Gabbs Lake Mining & Milling Co. treated the Dead Horse Wells tungsten tailings (Old Nevada Scheelite mill) and shipped concentrate to an ore buyer. R. H. Harms shipped tungsten concentrate derived from the Grutt-mine ore to a buyer. W. H. Stroud consigned tungsten ore from the Rawhide tungsten claims to a custom mill. Steven Corwin milled 351 tons of the Scheelite Extension-mine ore and shipped the tungsten concentrate to ore buyers. Harold W. Pilkington treated 1,340 tons of tungsten ore, which averaged 0.7 percent WO_3, from the Eagle mine and shipped concentrate produced. M. F. Porteous also shipped tungsten concentrate from the same property.

Santa Fe District.—The following operators consigned tungsten material to ore buyers: Louis and John Paloski, concentrate derived from 75 tons of Beacon mine ore; and Bernard York, concentrate produced from tungsten ore mined at the York mine.

Charles Bacon shipped tungsten ore from the Poor Man claim to a custom mill.

Silver Star District.—Fletcher & Cline operated the Defender tungsten mine and shipped ore to a custom mill. Earl Buffington operated the Buff claim and shipped tungsten concentrate to an ore buyer. Chauncey Florey operated the Silver Dyke underground tungsten mine in the Gold Range area throughout 1954 and concentrated ore in a gravity mill.

Nye.—Petroleum in commercial quantity, the first in Nevada, was produced from the Eagle Springs Unit No. 1 of the Shell Oil Co. in Railroad Valley, northeastern Nye County, in 1954. The announcement of the probable success of this well provided an incentive to increase the number of oil companies studying Nevada's oil possibilities from 5 to 45 in the summer of 1954. The Nevada Highway Department and its contractors produced gravel from several sites for highway use. A small shipment of antimony ore was made to a Texas smelter from an undesignated source in the county.

Belmont District.—L. J. Larson produced mercury by retorting ore mined at the Van Ness property.

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Butterfield Marsh (Railroad Valley Marsh) District.—Bryant Oxborrow shipped tungsten ore to a custom mill from the Goldenrod mine.

Clifford District.—A small shipment of gold-silver ore was made to the McGill smelter from the Terry-Cougar (Clifford) mine by Joe H. Clifford et al.

Cloverdale District.—Golden Iris Mining Co. shipped a small tonnage of gold ore to a smelter from the Golden Iris claims. The ore also contained silver.

Currant District.—Terrill Bros. worked the Nyco underground tungsten mine and treated the ore in their gravity-concentrating plant. The mine was developed by sinking an inclined shaft and exploring surface workings.

Fairplay District.—Big Top Tungsten Mine operated the Big Top mine and shipped tungsten ore to a custom mill.

Fluorine District.—Cind-R-Lite, Inc., produced volcanic cinders at the Cinder Cone mine, 20 miles south of Beatty. The material was used largely in the company building-block plant at Las Vegas, Clark County.

Jackson District.—David H. Walker shipped gold tailings from the War Eagle mine to the McGill smelter. The material also contained some silver.

Jett (Horse Canyon) District.—The Horse Canyon (Magee) mercury mine was operated by Jack and Fred Swanson, who retorted the mercury ore produced.

Johnnie District.—Ed C. Littleton recovered gold and silver by small-scale hand methods from the Congress placer-mine stream gravels.

Lodi (Ellsworth) (Mammoth) (Paradise Range) District.—The Standard Slag Co. shipped iron ore (magnetite) from the Phelps-Stokes (Iron Mountain) open-pit mine both for export and for domestic use. This company also quarried magnesite and operated the Gabbs plant. Magnesium oxychloride was produced from the magnesite in a flash furnace, and a rotary kiln was used to prepare refractory magnesia. Basin Refractories, Inc., produced magnesite and brucite at its open-pit mines 2 miles west of Gabbs. The company treated magnesite at a plant east of the mines, producing caustic calcined magnesia in Herreshoff furnaces. This material was used in processing dead-burned magnesia in a rotary kiln. The crude brucite was shipped to the eastern United States, where it was used in preparing magnesia. The Gabbs Exploration Co., one of the leading tungsten producers in the State, operated the Victory underground mine, about 8 miles north of Gabbs. Ore was concentrated in the campany gravity-flotation mill, and the concentrate was shipped to a Government stockpile. The El Capitan Mining Co. mined 1,621 tons of tunsten ore from the El Capitan underground mine and shipped the material to a custom mill for treatment. Toiyabe Mining & Milling Co. operated a custom gravity-flotation mill on local tungsten ores. The mill was sold to and subsequently operated by Yancy Milling Co. in September. Inca Development Corp. operated the Commodore underground tungsten mine and treated the ore in a gravity mill. The company also treated custom tungsten ores. R. E. Sutton worked the Doris and Madison tungsten claims

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as a weekend hobby and shipped a small quantity of ore to a custom mill. L. O. Warfield and L. D. Lashley prospected the Lexy No. 10 tungsten claim and made a shipment of ore to a custom mill. B. W. Van Voorhis shipped 24 tons of tungsten ore to a custom mill from the Ten O'Clock mine. Other shippers of tungsten ore were: R. R. Reed (Nelly mine), H. C. Conrad (Peak mine), Tom Cahill (Starlight claims), R. Bellville (White Diamonds claim), and C. H. Jones (Share Crop claim). Taglo Mining Corp. prospected the Ruby Ruth claims. Roy Rohlin milled tungsten ore from the Jewel claim in the Paradise Range area and, in addition, treated a small tonnage of custom ore.

Manhattan District.—John D. McKinnon et al. worked the Georgie group of placer claims with a dragline and nonfloating washing plant and recovered gold and silver. L. Cereghino operated the Lucky Strike drift placer mine, recovering small quantities of gold and silver. The Beryl Mining Co. worked the Beryl claim and shipped a small tonnage of silver ore to a smelter. Gold and silver were recovered by amalgamating gold ore at the following small mines: Big Four mine (Emerson J. Hyde); Earl claim (John J. Mills); Gold Metals group of claims (Nathan Blake); Otario mine (William Hammond); Silver King claim (A. C. Albrecht and E. J. Arnold); and Stray Dog mine (Jumping Jack Merger Mines Co.). Silver was contained in gold ore shipped to a smelter from the Future mine by L. Cereghino and L. J. Larson. Robert Selig treated gold ore from the Sunshine mine in a 25-ton flotation mill and recovered gold and silver by amalgamating the concentrate.

Reveille District.—W. Fann worked the Danny Boy claim and shipped silver ore to the McGill smelter. R. G. McCracken & Co. shipped lead concentrate and some lead ore to a Utah smelter from the Reveille-mine dump. The material also contained silver and small quantities of gold and copper.

Round Mountain District.—G. E. Lewis made a small shipment of gold-silver cleanup material to a smelter from the Gold Hill mine. Ed Critchfield operated the Shoshone Fraction and Mary McLain placer drift mines and recovered gold and silver. Producers of tungsten ore from small mines included: Joe Sayers & Joan Lani (Butch mine), A. K. Saylor (Cactus mine), Bob Wilson (Dutch, New Year, and Ophir mines), Lani & Schuck (Ella mine), Jack Peters (Four Kings mine), L. & W. Tungsten (Jett mine), and Paul Littell (Ophir mine).

Tonopah District.—L. D. Foreman & Co. shipped silver tailing, containing gold, lead, and zinc, to a California smelter-fuming plant from the Liberty-mine dumps. Summit King Mines, Ltd., Special Account, operated the Summit King (Tonopah King) mine and shipped silver ore to the McGill smelter. The ore also contained gold. Merritt Bros. (Starlight mine) and Nicely & Cirac (Susie claim) shipped tunsten concentrate to an ore buyer.

Troy District.—C. W. Meyer worked the Nye underground tungsten mine and treated the ore in his gravity mill. Concentrate was shipped to ore buyers.

Twin River (Millet) District.—Early, Moore & Stokes concentrated tungsten ore from the Bobby mine in Ophir Canyon by gravity milling. Vaughn, Chico & Rogers developed ore at the New Moose tungsten claim.

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Tybo District.—Joe Clifford & Sons mined and retorted mercury ore from the A & B mine. J. A. Hunt, N. J. Grover, and O. Stockman and M. F. and Lorena Peterson also mined and retorted mercury ore from the M & M mine.

Union District.—Paul Littell made a small shipment of lead concentrate, derived from Alexander and Brooklyn mine silver tailing, to a California smelter. He also shipped tungsten concentrate from the Silver Palace mine to an ore buyer. The M & M Mining Co. shipped a small tonnage of cleanup material containing copper from the Copper King group of claims to a smelter. Noel Barnes mined and retorted 80 tons of mercury ore from the Mercury (Prescott) underground mine. R. L. Tiefel & C. J. Smith shipped fluorspar from the Sea Bee group of claims in Venice Canyon near Ione to a custom mill at Fallon, Churchill County. R. C. Ames developed ore at his Allied group of fluorspar claims, situated 1½ miles south of Grantsville.

Ormsby.—John L. Savage Construction Co. produced sand and gravel near Carson City for general construction. The Nevada Highway Department produced gravel for miscellaneous highway projects.

Delaware District.—Charles Stewart recovered gold and silver by amalgamating gold ore from the Lone Pine mine.

Pershing.—The United States Gypsum Co. operated a perlite quarry, situated 12 miles northwest of Lovelock. Crude perlite was sized at the Kodak mill, 4 miles northeast of Lovelock, and some of it was expanded at the Empire plant in Washoe County. The Nevada Highway Department produced gravel for various highway projects.

Antelope District.—Parker Bros. operated the Thomas lease and shipped magnetite ore to eastern steel plants. Mercury ore from the Vulture group of claims was mined and retorted by G. C. Rollins.

Hooker District.—Fred M. Anderson et al. and Modoc Mines & Exploration Co. operated the Stormy Day underground tungsten mine. Ore was shipped to custom mills by both operators. Exploration continued under an amended DMEA contract. It consisted of diamond drilling for a downward extension of the ore body. The United States Gypsum Co. operated the Empire gypsum quarry 12 miles south of Gerlach. The crude material was processed at the company plant in Washoe County.

Humboldt (El Dorado) (Imlay) District.—Clayton G. Campbell amalgamated gold ore from the Windy Day claim and recovered gold and silver. Noble Bros. operated the Black Jack-El Dorado mercury mine, and T. A. Cowan and M. G. White worked the Little Linda mine for mercury. The ore mined from each property was treated in retorts. Winnemucca Mountain Mines operated the Star underground tungsten mine 4 miles west of Humboldt and shipped ore to a custom mill. Barney Dennison shipped fluorspar from the Fluorine (Valery) group of claims to a custom mill at Fallon.

Iron Hat District.—A small quantity of tungsten ore was shipped to a custom mill from the True American mine by John B. Blossom and William Hernandez.

Juniper Range (Juniper) District.—William R. Bailey explored the Blue Wing underground mine for tungsten. W. O. Cheeseman and

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H. H. Davidson shipped a small quantity of tungsten concentrate to an ore buyer from the I Wonder mine.

Lava Bed District.—Gene Bailey developed tungsten ore at the Sage Hen group of claims in 1954.

Mill City (Central) District.—Nevada Massachusetts Co., the largest producer of tungsten concentrate in Nevada in 1954, operated the Tungsten group of open-pit and underground mines 9 miles north of Mill City. A gravity-flotation mill was operated in conjunction with an acid treatment and magnetic separation section on company ore only. The ore treated averaged 0.37 percent WO_3. Finished concentrate was shipped to Government stockpiles.

Mineral Basin District.—Dodge Construction, Inc., the largest shipper of iron ore in the State, consigned magnetite ore from the Segerstrom & Heizer open-pit mine for export. Nevada Iron Ore Co., Inc., shipped similar material to eastern steel plants from the Thomas-Chick Thomas mine.

Nightingale District.—The Wolfram Co. operated the Star-Nightingale underground and open-pit tungsten mine and milled the ore at the company Toulon gravity mill. Custom ore, principally from local mines, was also treated at the mill.

Rabbit Hole District.—Constant Minerals Separation Process, Inc., recovered gold and silver from gravel washed at the Monkota (Barrel Spring) mine.

Ragged Top District.—W. M. Cooney & Sons operated the Cooncan underground tungsten mine and the Cooncan gravity mill. Custom ore was also treated, besides the 1,360 tons of Cooncan ore, which yielded 560 units of WO_3. Carson Tungsten Co. and George Holcomb and Frank Wilkerson worked the M. G. L. tungsten mine and dumps, and E. J. Aherin shipped mill tailing from the same property to a custom mill for re-treatment. J. F. DeLaMare shipped tungsten ore to a custom mill from the Ragged Top mine. Trojan Mining & Milling Co. developed ore at the Sheba-Elenor-Trojan group of tungsten claims and shipped ore to a custom mill for treatment. W. M. Fisher shipped tungsten concentrate, derived from the Tungsten Bell tailing, to an ore buyer.

Relief (Antelope Springs) District.—Redbird Leasing retorted mercury ore from the Redbird mine.

Rochester District.—Bert Goodwin recovered gold by amalgamating a small quantity of gold ore from the Limerick mine. L. Mills Beam shipped tungsten concentrate produced from ore mined at the Stowe mine to an ore buyer.

Rocky Canyon District.—Nevada Uranium Co. continued exploration for uranium ore in the early part of 1954 under a DMEA contract on the Stalin's Present mine. Work consisted of trenching, shaft sinking and rehabilitation, and crosscutting.

Rye Patch (Echo) District.—Charles S. Moore and Charles Shortino shipped a small quantity of tungsten ore from the Rye Patch mine to a custom mill.

Scossa District.—Harold E. Reed amalgamated gold ore from the Red Rock group of claims and recovered gold and silver.

Seven Troughs District.—C. E. Thomsen and H. R. Ruckteschler recovered gold and silver from the Fairview mine, gold ore by amalgamation, as did J. T. Summers, who treated the Portland Extension-

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mine gold ore. J. L. Nickerson worked the Sure Thing claim and shipped some tungsten concentrate to an ore buyer.

Sierra (Rose Creek) District.—Duane Devine and Reeve Fagg worked the Gold Spell prospect (Rose Creek Lease) sporadically and shipped some tungsten ore to a custom mill. Leo K. Johnson worked the Rose Creek underground tungsten mine and shipped 115 tons of ore to a custom mill.

Spring Valley District.—The W. Erle Simpson Co. retorted dump ore from the Hillside mercury mine.

Storey.—*Clark District.*—The Eagle-Picher Co. operated the Celatom open-pit mine about 20 miles east of Sparks. The diatomaceous earth produced was crushed and calcined at its plant east of Sparks.

Comstock Lode (Comstock) District.—D. T. Powell shipped gold-silver cleanup material to a smelter from the Consolidated Chollar (Overman) mine. Copeland and Knight cyanided Justice-mine gold ore and recovered gold and silver. Gold-silver tailing from the Six Mile Canyon mine was cyanided by Double King Mines, Inc. Cecil W. Kirk amalgamated a small quantity of silver tailing from the United Comstock mine.

Washoe.—Fire brick and heavy clay products were manufactured by the Reno Press Brick Co. at its Reno plant. The clay was produced at pits 10 miles south and 12 miles east of the city. The Nevada Highway Department and its contractors prepared sand, gravel and crushed miscellaneous stone for several highway construction projects. The Federal Bureau of Mines Rare and Precious Metals Station at Reno was activated in May 1954.

Galena District.—Constant Minerals Separation Process, Inc., shipped a small tonnage of lead ore containing silver and zinc to a California smelter-fuming plant from the Galena Hill mine.

Hooker District.—United States Gypsum Co. calcined gypsum produced in Pershing County at the company 500-ton-a-day-capacity Empire plant. In addition, some perlite produced in Pershing County was expanded at the plant.

Nightingale District.—Cal-Alta Oil & Mining Co. shipped 158 tons of tungsten ore averaging 0.97 percent WO_3 to a custom mill from the Crosby mine. Zet Turner shipped tungsten ore to a custom mill from the Angela claim.

Olinghouse (White Horse) District.—Emile Cabanne worked the Babe claim, and the Cabin No. 2 claim with H. H. Karlskind. Gold and silver were recovered at both properties by amalgamation. H. H. Karlskind also amalgamated gold- and silver-bearing cleanup material from the Slip claim. O. L. Taylor recovered gold and silver from a small tonnage of gold ore mined from the Margaret group of claims. Angelo Mangini worked the Texas No. 2 claim and recovered gold and silver from the ore by amalgamation.

Peavine District.—Isbell Construction Co. produced crushed basalt for concrete and road metal at its Reno pit.

Pyramid District.—J. B. LaGue shipped copper concentrate, containing some silver, and copper precipitate to a Utah smelter. The copper ore treated was from the Cincaid Perry mine. Calcareous marl was produced by Double Check Products, Co. at the Double Check mine near Flanigan and by Marl-Gro, Inc., near Nixon.

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White Pine.—The Nevada Highway Department and its contractors produced sand and gravel from several sites for highway construction.

Aurum District.—Grand Deposit Mining Co. shipped lead ore containing gold, silver, copper, and zinc to a Utah smelter from the Grand Deposit mine. Lead ore containing silver was shipped to a Utah smelter by Garrett Pierce from the Last Chance mine. Ernest E. Sandoval and Calvin Troester worked the White Horse claim and shipped tungsten concentrate to an ore buyer.

Bald Mountain District.—Bisoni & Vaccaro shipped tungsten ore (scheelite and powellite) to a custom mill from the Bald Mountain underground mine.

Black Horse District.—K & B Mining Co. shipped silver ore to the McGill smelter from the Valley View mine.

Chase District.—Lead ore containing silver was shipped to a Utah smelter from the Bellview mine by Solomon & Wade.

Cherry Creek District.—C. L. & D. A. Johnson shipped a few tons of gold ore to a smelter from the Black Sheep claim. The ore also contained silver. Metallics Unlimited also shipped silver ore, containing some gold, to the McGill smelter from the Pine Nut mine. Silver ore was shipped to a smelter from the Star mine by E. R. Smith. F. W. Barger shipped a small quantity of tungsten concentrate derived from the Bluebird No. 1 claim ore to an ore buyer. A. L. Ruggles worked the Big Giant (Exchequer group) tungsten mine and shipped ore to a custom mill. Sam Bida mined and milled 248 tons of tungsten ore from the Fillmore (Scheelite King) underground mine. A gravity mill was used, but mine and mill operations ceased the latter part of 1954. C. V. Almandinger and Noel Shnee shipped tungsten ore from the King Midas underground mine to a custom mill. Ruggles & Dolan developed the Gypsy underground tungsten mine and shipped some ore to a custom mill. Schafer & Duval developed tungsten ore at the Happy group of claims. Bankson & Ruggles et al. shipped tungsten ore averaging 2.1 percent WO_3 to a custom mill from the Only Chance underground mine. Tungsten tailings were also shipped from the same property to a custom mill for treatment. Metallics Unlimited also worked the Pine Nut mine for tungsten ore to about the middle of 1954 and shipped tungsten concentrate to a Government stockpile. Exploration work, consisting of drifting, crosscutting, and raising under an amended DMEA contract, was completed early in 1954. Jack Pouch also worked the Pine Nut mine but shipped tungsten ore to a custom mill. Cherry Creek Tungsten Mining Co. operated the Ticup tungsten mine and milled most of the ore in the company gravity-flotation mill. The company also milled local custom ore.

Duck Creek District.—Jeanette G. Bigger produced 496 tons of fire clay in Mosier Canyon east of Ely. The material was used for fire-clay mortar. This deposit formerly was reported in the Robinson district.

Granite (Steptoe) District.—A small quantity of gold ore containing silver was shipped to the McGill smelter from the Piedmont mine by the Piedmont Mining Co. Robert Salvi shipped tungsten concentrate to an ore buyer from the Valley View underground mine. Harold

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Sibley shipped lead ore containing some silver to a Utah smelter from the Cuba claim.

Mount Washington District.—Mount Wheeler Mines, Inc., developed and operated the Mount Wheeler underground tungsten mine. The company shipped 430 tons of ore to a Utah plant for treatment. Exploration, consisting of drifting and crosscutting, continued under an amended DMEA contract.

Nevada District.—The Manganese Mining Co. shipped manganese ore from the Manganese (Essex) underground mine to Government stockpiles. Several drifts were extended under a DMEA exploratory contract.

Newark District.—A. R. Laird and E. M. Thayer shipped a small quantity of silver ore to the McGill smelter from the Bay State mine. E. M. Thayer also shipped lead-zinc ore to a Utah smelter from the Glyndon mine.

Osceola District.—Hemet Milling & Processing Co. shipped dump material from the Gilded Age mine to the McGill smelter for flux. The material contained some gold and silver. Edward V. Abott worked gravels from the Gold Nugget and North Star by drifting, and produced gold and silver. Mrs. Bonita Tilford worked the Three Sisters tungsten placer and shipped concentrate to an ore buyer. L. T. Tilford shipped a small quantity of tungsten ore from the Shipper underground mine to a custom mill, and R. D. Tilford developed tungsten ore at the Big Foot claim in 1954.

Robinson District.—Kennecott Copper Corp., Nevada Mines Division, combined pit and underground operations, was the largest producer of copper, the second largest producer of gold, and third in output of silver in Nevada in 1954. Milling ore from the Ruth (Liberty) pit, the Kimbley pit, the Deep Ruth development, and the nearby Consolidated Coppermines Corp. properties was treated in the company 21,000-ton-daily-capacity concentrator at McGill. Molybdenum concentrate was recovered as a byproduct of this copper-ore milling operation. The copper concentrate produced at the McGill mill (in addition to a considerable tonnage of copper concentrate from Kennecott's Utah property), copper precipitate recovered from mine water using scrap iron, direct-smelting copper ore from the Kimbley pit and custom shippers, and custom gold and silver ores used primarily for their fluxing properties were all reduced at the Kennecott smelter, adjacent to the copper concentrator at McGill. The smelter product was blister copper, which was refined at Baltimore, Md., and Carteret, N. J., by American Smelting & Refining Co. and United States Metal Refining Co., respectively. The development of the Veteran pit, owned jointly with Consolidated Copper Mines Corp., west of Ruth, and the Deep Ruth mine, near the old townsite of Ruth, continued in 1954.

Output from Consolidated Coppermines Corp. Morris and Brooks pits and the Ruth (Liberty) pit extension made this company the third largest producer of copper and fourth-ranking producer of both gold and silver in Nevada in 1954. Operation of the Morris and Brooks pits was under contract, and the Ruth (Liberty)-pit extension was worked under agreement by Kennecott Copper Corp. All milling ore from these mines was shipped to Kennecott's McGill concentrator for treatment, and some fluxing ore from the Morris pit

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was consigned to McGill for direct smelting. H. W. Bishop leased the Emma mine and shipped a small tonnage of lead ore, also containing some gold, silver, and copper, to a Utah smelter. John Zunino et al. worked the Napoleon mine and shipped copper ore containing a trace of gold to the McGill smelter.

Manganese and manganiferous ore were shipped to Government stockpiles in 1954 by Sam Robison from the Keystone mine and by Consolidated Coppermines Corp. from the Isaacs claim, both, underground operations.

Minerals Engineering Co. operated a tungsten flotation-chemical mill on company and custom ores at Lackawana Springs for several months in 1954. The low-grade concentrate produced was shipped to a Utah plant for further treatment. Baltimore-Camas Mines, Inc., had operated this mill earlier in the year.

The quarrying of limestone near McGill, used as a flux material and as a source for the lime prepared at the company kilns at McGill, was an integral part of the Nevada Mines Division operation of Kennecott Copper Corp.

Shoshone (Minerva) District.—Kerr & Jeppson mined 1,184 tons of tungsten ore, averaging 1.0 percent WO_3, from the Canary Yellow underground mine. Ore was shipped to a custom mill. M. I. A. Mines Co. continued to explore the Minerva underground tungsten mine under a DMEA contract by advancing several levels. Ore was shipped to a Utah treatment plant. Minerva Scheelite Mining Co. developed the Scheelite Chief tungsten mine and treated development ore and custom ore in the company gravity mill. Smith & Stopper treated tungsten tailings from several sources in the district at the Stopper mill.

Taylor District.—Imperial Nevada shipped silver ore from the Taylor mine to a smelter.

Tungstonia (Eagle) (Regan) District.—Wilford J. Rees developed and shipped tungsten ore from the Antelope underground mine near Tippett to custom mills. The ore averaged about 3.7 percent WO_3. A. E. Gull & Associates operated the Tungstonia tungsten mine for a portion of 1954 and shipped hübnerite ore to a custom mill.

Ward District.—The Walker Corp. and O. B. Mining Co., lessee, continued to develop the Ward mine and shipped 151 tons of lead ore containing gold, silver, and copper to a Utah smelter. Exploratory diamond drilling under a DMEA contract was terminated early in 1954.

White Pine District.—Lead ore was shipped to a Utah smelter from the Belmont mine, operated by the Belmont Mine & Mill Co. Gold and silver was contained in the ore. Minerals Engineering Co. operated the Monte Cristo open-pit mine and shipped tungsten ore to the company mill near Ely.

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The Mineral Industry of New Hampshire

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, United States Department of the Interior, and the New Hampshire State Planning and Development Commission.

By Robert D. Thomson [1]

NEW HAMPSHIRE'S mineral production in 1954 was valued at $2,112,000, 17 percent over 1953. Some production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with Census totals when they are available and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage. Nine mineral commodities, sand and gravel, stone, feldspar, mica, clays, beryl, abrasives, columbium-tantalum, and peat, in order of value, were marketed in 1954. Production was reported from every county, with Merrimack, Grafton, and Cheshire the centers of greatest activity. Employment reported by 24 mining companies totaled 202 persons at an average earning of $4,322.

TABLE 1.—Mineral production in New Hampshire, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Beryllium concentrate	57	$32,640	12	$6,960
Clays	45,198	41,427	35,681	35,681
Columbium-tantalum concentrate—pounds gross weight	770	1,309	255	433
Feldspar long tons	28,961	286,069	(2)	(2)
Mica	[3] 45	[3] 382,680	[4] 346	246,033
Sand and gravel	2,249,001	506,156	2,240,548	1,094,474
Stone	76,701	538,897	72,486	473,298
Undistributed: Abrasive stones, scrap mica (1953), peat and minerals whose value must be concealed for particular years (included in appropriate column by footnote reference 2)		15,617		255,226
Total New Hampshire		1,805,000		2,112,000

[1] Production by mine shipments, or marketable production (including consumption by producers).
[2] Included with "Undistributed."
[3] Sheet mica only.
[4] Includes sheet and scrap mica.

[1] Commodity-industry-analyst, Region V, Bureau of Mines, Pittsburgh, Pa.

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REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasives (Scythestones).—Sales of scythestones, a quartz-mica schist, in 1954 declined slightly compared with 1953. Norton Pike Co. continued to be the only operator in New Hampshire and reported that its mine in Grafton County permanently closed in 1953 with sales in 1954 made from a stockpile. The trimmed and handfinished rock was sold as sharpening stone.

Clays.—Four companies produced clays in New Hampshire in 1954. Output was limited to miscellaneous clays, showing a drop of 21 percent in tonnage and 14 percent in value. All pits were captive operations, with 2 pits in Rockingham County and 1 each in Grafton and Strafford Counties.

Feldspar.—Output of crude feldspar in 1954 declined slightly in tonnage and value compared with 1953. Four companies operated a total of 6 mines—2 mines each in Cheshire and Grafton Counties and 1 each in Merrimack and Sullivan Counties. Two crude producers operated grinding mills and sold the ground feldspar to the pottery industry.

Mica.—Production of sheet and scrap mica in 1954 totaled 346 short tons valued at $246,000. Many small trimming shops were active in 1954 for processing mine-run mica. Sheet mica was sold to industry at an average price of $1.41 per pound and to the GSA Purchasing Depot at Franklin at an average price of $9.50 per pound. Industry purchased punch, hand-cobbed, half-trimmed, and full-trimmed mica, but only hand-cobbed mica and full-trimmed mica were sold to the Government. Twenty-six mines in Cheshire, Coos, Grafton, Merrimack, and Sullivan Counties were active in 1954. Only seven of them yielded marketable scrap mica.

Sand and Gravel.—Sand and gravel was New Hampshire's principal mineral product in 1954 and contributed 52 percent of the total State value. Output of sand and gravel decreased less than 1 percent in tonnage in 1954 compared with 1953 but increased 116 percent in value owing mainly to increased coverage of the industry. Eleven companies in Belknap, Carroll, Cheshire, Grafton, Hillsboro, Merrimack, and Strafford Counties produced both sand and gravel, while 3 companies—1 each in Coos, Grafton, and Strafford Counties—produced only sand and 2 companies—1 each in Carroll and Coos Counties—mined only gravel. The largest part of the State production was sold for structural and paving use. Government output of sand and gravel was reported in 1954 from Hillsboro and Merrimack Counties.

Stone.—The stone industry ranked as the second most important mineral industry for tonnage and value in New Hampshire in 1954. Stone production dropped from first place in total value compared with 1953 but remained second for tonnage. Granite and miscellaneous stone were quarried in Merrimack, Rockingham, and Coos Counties, in order of output. Dimension granite was produced as rough construction and dressed architectural stone. Some granite was crushed for use as riprap and concrete aggregate, but most of the crushed stone was miscellaneous stone for concrete aggregate. The

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New Hampshire Department of Public Works and Highways was the only noncommercial producer reporting stone production in 1954.

METALS

Beryllium.—In 1954 New Hampshire ranked seventh in the United States in production of beryl, although output decreased in both tonnage and average value compared with 1953. The entire production was sold to the General Services Administration (GSA) Purchasing Depot at Franklin. Mines were active in Belknap, Cheshire, Grafton, and Sullivan Counties.

MINERAL FUELS

Peat.—A small tonnage of peat was produced from bogs in Belknap County in 1954. It was sold mainly for agricultural uses.

REVIEW BY COUNTIES

Belknap.—Mineral production in Belknap County consisted of sand and gravel, peat, and beryl. Tilton Sand & Gravel, Inc., produced sand and gravel for building and road construction from its pit at Tilton. Frank L. Leggett produced beryl.

Carroll.—Sand and gravel was the only mineral product produced in Carroll County in 1954. Sparks Construction produced sand and gravel for building and road construction. Edwin Sinclair produced structural gravel.

TABLE 2.—Value of mineral production in New Hampshire, 1953–54, by counties

County	1953	1954	Minerals produced in 1954 in order of value
Belknap	(1)	(1)	Sand and gravel, peat, beryl.
Carroll	----------	(1)	Sand and gravel.
Cheshire	$311,410	$220,321	Feldspar, sand and gravel, beryl, mica, columbium-tantalum.
Coos	(1)	(1)	Stone, sand and gravel, mica.
Grafton	352,336	405,869	Mica, sand and gravel, feldspar, clays, abrasives, beryl, columbium-tantalum.
Hillsboro	(1)	(1)	Sand and gravel.
Merrimack	643,117	1,034,368	Sand and gravel, stone, feldspar, mica.
Rockingham	(1)	(1)	Stone, clays.
Strafford	(1)	(1)	Sand and gravel, clays.
Sullivan	89,292	86,687	Mica, feldspar, beryl.
Undistributed	408,640	364,860	
Total	1,805,000	2,112,000	

[1] Value included with "Undistributed."

Cheshire.—Cheshire County dropped from second-ranking county in New Hampshire in value of mineral output in 1953 to third in 1954. Feldspar, the leading commodity produced in 1954, was produced by Golding-Keene Co. and Whitehall Co., Inc. Crude feldspar produced

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by Golding-Keene Co. at the Colony mine was ground at the company plant in Alstead. Crude feldspar produced at the Turner mine, Marlow, by Whitehall Co., Inc., was shipped out of the State for processing. Sand and gravel was produced by Keene Sand & Gravel, Inc., Swanzey Center, and Warren Plimpton, Dublin, for building and road construction. Beryl was obtained from the Colony mine, Alstead, by Golding-Keene Co. Otto K. Lassman operated the French mine, Gilsum, and sold hand-cobbed mica on the open market and to the GSA Depot at Franklin. In addition, Lassman sold beryl to the GSA Depot. John L. Maderic produced mica from the Osborne mine, Alstead, while Fred W. Ryan worked the Kingsbury mine, Surry. Both Maderic and Ryan processed the mica and sold full-trimmed block mica to the GSA Depot. Arthur Lee sold a small quantity of columbium-tantalum mined at various locations in Cheshire County.

Coos.—Stone, sand and gravel, and mica were mined in Coos County in 1954. Henry A. St. Laurent produced granite for rough construction work from a quarry near Berlin. Sand for structural use was produced by Fred Corrigan at Randolph. Main Central Railroad Co. operated a gravel pit near Colebrook for railroad ballast. A small quantity of full-trimmed mica was sold to the GSA Depot by Leo A. Guirin.

Grafton.—Grafton County ranked second among New Hampshire counties in value of mineral output in 1954, and had the greatest variety of mineral products, including mica, sand and gravel, feldspar, abrasives, beryl, and columbium-tantalum. Mica was produced by 18 operators at 16 mines in 1954. Only 4 of the 18 producers sold scrap mica.

The 10 leading mica operators in 1954 were as follows:

Company:	*Mine*	*Location*
Whitehall Co., Inc	Ruggles	Grafton.
Ashley Mining Corp	Palermo	Do.
Strafford Mines, Inc	Nancy	Do.
Edward R. Lupien, Jr	McGinnis	Wentworth.
Charles H. and Theresa G. Tarr.	Tarr	Grafton.
Arthur Lee	Ruggles	Do.
Donald E. Esty	Fletcher	Groton.
Raymond C. Woods	Dufour	Wentworth.
W. D. Wood, Inc	Draper and Wood	Groton.
Do	Hoyt Hill	Orange.
Do	Dufour and McGinnis	Wentworth.
Virginia D. Harriman	Draper	Groton.
Do	Tarr	Grafton.
Do	Dufour and Harriman	Wentworth.
Do	Perkins	West Rumney.

In addition to mica, the Whitehall Co., Inc., produced feldspar and beryl from the Ruggles mine, and Ashley Mining Corp. produced beryl and columbite-tantalite from the Palermo mine. Fred W. Ryan and Reginald H. Ball operated the Valencia mine, Groton, for beryl. Sand and gravel, mainly as paving material, was produced by Twin State Sand & Gravel Co., Inc., West Lebanon; Littleton Sand &

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Gravel Co., Inc., Littleton; Daniels Construction Co., West Lebanon; and Campton Sand & Gravel Co., Inc., West Campton. The Golding-Keene Co. produced potash feldspar from the No. 10 mine near Grafton. Miscellaneous clays were produced by Densmore Co. near Lebanon for the manufacture of heavy clay products at the local company plant. Norton Pike Co. reported that its mine at Littleton was closed in 1954, but sales were made from a stockpile.

Hillsboro.—Sand and gravel was the only mineral product produced in Hillsboro County in 1954. Mason K. Harris produced bank-run sand and gravel near Peterborough and sold the screened material as structural and paving material. Robie Construction Co., Inc., crushed and screened sand and gravel at a plant near Manchester for use in construction. Sand and gravel as paving material was produced by the Manchester Department of Highways.

Merrimack.—Mineral production in 1954 in Merrimack County consisted of sand and gravel, stone, feldspar, and mica. Manchester Sand, Gravel & Cement Co., Inc., operated a pit and preparation plant at Hooksett for producing structural and paving sand and gravel and engine sand. Sand and gravel also was reported as being produced by the Commissioner of Public Works, Concord, and the New Hampshire Department of Public Works and Highways. The John Swenson Granite Co., Concord, was the only producer of stone in Merrimack County in 1954. Stone production was granite only; it was sold as riprap, concrete aggregate, and dimension stone. The New Hampshire Department of Public Works and Highways produced granite as construction material. Julian Wetherbee operated a pegmatite mine near Wilmot, producing a small quantity of potash feldspar and mica.

Rockingham.—Stone and clays were produced in 1954 in Rockingham County. Miscellaneous stone was quarried at the Iafolla quarry, Portsmouth, by Iafolla Crushed Stone Co. for use in road construction. Both Eno Bros. Brick Co. and W. S. Goodrich, Inc., produced miscellaneous clays in 1954. The Eno Bros. Brick Co. operated a pit near Exeter and used the clay in the production of brick. W. S. Goodrich, Inc., operated a pit near Epping for use in producing heavy clay products.

Strafford.—Mineral production in Strafford County consisted of sand and gravel and clays. Sand and gravel produced by Dover Sand & Gravel, Inc., near Madbury was trucked to the preparation plant at Dover and sold to the construction industry. Structural sand was quarried by James S. Pike. Miscellaneous clays were produced by the New England Brick Co. from an open pit at Rochester and used at the Gonic plant for producing heavy clay products.

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Sullivan.—Potash feldspar was produced at an underground mine by J. F. Morton, Inc., north of Alstead. The crude feldspar was trucked to the company grinding mill at North Walpole, Cheshire County, and the ground feldspar was sold mainly to the pottery industry. Mica and beryl were produced by Fred L. Smith at the Smith mine, Newport, and Smith & Smith Co., Independence mine, East Lempster. The Newport Mining Co. and Sargeant Mining Co. produced mica from the Sargeant mine, Newport; H. L. Robinson operated the Kent, Newport, and Smith mine, Claremont; Kenneth L. Smith operated the Kenneth Smith mine, Unity Center; and Fred L. Smith worked the Smith mine.

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The Mineral Industry of New Jersey

By Alvin Kaufman [1] and C. Geraldine Cleary [2]

THE VALUE of mineral production in New Jersey declined 9 percent in 1954 compared with 1953, largely because of a drop in output of iron ore, zinc, and stone, accompanied by decreases in the total values of these commodities. Twelve minerals were produced in New Jersey in 1954. Nonmetals were the largest group, contributing approximately two-thirds of the value. Metals, consisting of iron ore, zinc, and manganiferous residuum, comprised the other third. The principal producing counties were Sussex, Morris, Cumberland, Passaic, and Somerset, in order of decreasing value. These 5 supplied 74 percent of the State's mineral value.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with Bureau of the Census totals when they are available and differences adjusted or explained. The Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

TABLE 1.—Mineral production in New Jersey, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	532,185	$1,326,297	[2] 578,344	[2] $1,246,099
Iron ore (usable)—long tons, gross weight	815,905	10,114,970	476,192	6,621,881
Manganiferous residuum—gross weight	293,758	[3]	214,913	[3]
Marl (greensand)	6,821	193,404	2,101	184,834
Peat	21,706	[3]	[3]	[3]
Sand and gravel	7,361,935	10,835,948	10,005,325	14,704,474
Sand and sandstone (ground)	127,921	918,534	[4]	[4]
Stone	6,036,259	13,307,856	5,772,200	12,109,950
Zinc (recoverable content of ore, etc.) [5]	45,700	9,922,990	37,416	7,992,058
Undistributed: Lime, magnesium compounds, marble, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes limestone used in the manufacturing of lime (1954)		5,325,148		4,184,432
Total New Jersey		51,945,000		47,044,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Final figure. Supersedes data shown in commodity chapter.
[3] Included with "Undistributed."
[4] Included with sand and gravel.
[5] Recoverable zinc valued at the yearly average price of Prime Western slab zinc, East St. Louis market. Represents value established after transportation, smelting, and manufacturing charges have been added to the value of ore at mine.

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REVIEW BY MINERAL COMMODITIES

METALS

Iron Ore.—Production of crude iron ore in New Jersey dropped 34 percent in 1954 compared with 1953. Shipments of usable ore, primarily concentrate for pig-iron manufacture, declined 42 percent compared with 1953. Virtually all the crude ore produced (97 percent) was shipped to concentrators. As in previous years, 5 mines were active: 3 in Morris County, 1 in Passaic County, and 1 in Warren County. The average value of New Jersey iron ores rose from $12.40 in 1953 to $13.91 in 1954. Peters mine of Ringwood Iron Mines Co., Inc., Passaic County, ceased production on May 1, 1954, owing to lack of orders from steel companies. The Warren Foundry & Pipe Co. Mount Hope mine was closed from April to June of that year. This company began stripping an area near Hibernia preparatory to surface-mining magnetite iron ore.

TABLE 2.—Production and shipments of iron ore, 1945–49 (average) and 1950–54, by uses, in long tons

Year	Number of mines	Crude ore mined	Shipments of usable ore						
			Direct shipping ore	Concentrates	Cement	Paint	Miscellaneous	Total shipments	Value
1945–49 (average)	4	880,852	127,515	301,779	8,039	293	2,729	440,355	$3,581,547
1950	4	1,090,826	138,451	435,096	14,125	56	471	588,199	5,651,563
1951	4	1,166,495	193,143	454,555	9,967	74	191	657,930	7,810,776
1952	5	1,318,599	166,962	505,136	13,272	96	--------	685,466	6,760,467
1953	5	1,558,384	177,475	633,128	5,302	--------	--------	815,905	10,114,970
1954	5	1,025,057	18,584	456,379	1,229	--------	--------	476,192	6,621,881

Magnesium Compounds.—The Northwest Magnesite Co., Cape May County, continued producing refractory magnesia from dolomite and sea water in 1954. Johns-Manville Corp., Somerset County, and J. T. Baker Chemical Co., Warren County, produced various magnesium compounds from dolomite and purchased magnesium carbonate. To avoid duplication of output data, only the magnesia produced from raw sea water is included in the mineral output of the State.

Manganiferous Residuum.—Manganese for use in preparing spiegeleisen, an iron-manganese alloy consumed by the steel industry, continued to be recovered as a byproduct of zinc ore milling.

Zinc.—The most notable event in the State zinc industry in 1954 was the closing, after more than 100 years of production, of the Franklin mine on October 1, 1954, due to depletion of the ore body. The New Jersey Zinc Co., owners and operators of the mine, estimated that less than one-tenth of 1 percent of the original ore was left in the mine at its closing. The Sterling mine near Ogdensburg, also owned by the New Jersey Zinc Co., continued to operate during the year. A new shaft was completed at this mine, and work proceeded on construction of a new crushing and grinding mill and other surface facilities.[3] The new plant will use conveyor belts to facilitate

[3] New Jersey Zinc Co., Annual Report: 1954, p. 6.

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a continuous flow of ore. Belts will be used to convey ore from the shaft head to the mill and throughout the plant for crushing and grinding operations. In addition, a 570-foot segment of the conveyor system will be erected to carry ore to loading bins near the old mill.[4]

TABLE 3.—Mine production of recoverable zinc, 1945–49 (average) and 1950–54

Year	Short tons	Year	Short tons
1945–49 (average)	70,007	1952	59,190
1950	55,029	1953	45,700
1951	62,917	1954	37,419

NONMETALS

Clays.—Output of clays increased 9 percent in 1954 compared with 1953. Production was reported from 10 counties, the largest of which were Middlesex, Burlington, Warren, Bergen, and Camden, in order of decreasing value. These 5 supplied 88 percent of the State's clay tonnage; Middlesex County alone was responsible for 57 percent.

Fire clay output comprised 21 percent of New Jersey's total clay tonnage and 59 percent of value. This commodity was used primarily for refractory and heavy-clay-products manufacture. Production was from mines in Middlesex County, with a small output coming from Burlington and Cumberland Counties. There were 23 clay mines active in the State in 1954, of which the Ru-Mar Contracting Co., Inc., Hudson County, was the only underground operation. The other 22 were surface mines. Major clay producers were Sayre & Fisher Brick Co., Middlesex County, and Natco Corp., Middlesex and Warren Counties.

New Jersey Shale Brick & Tile Corp. broke ground for a new brick plant at Somerville on January 2, 1954. The plant was operating at a rate of 350,000 brick per week by August. The new plant features automatic operation and interlocking controls. Pugging is done in a Bonnot combination pug mill-auger machine with automatic water feed and oil lubricating systems. Brick are moved into the 112-foot, 2-compartment, Hendryx drier on 10-foot kiln cars. The kiln is 243 feet long, and is fired on a 44-hour schedule with a peak temperature of 1,850° F.[5]

Greensand Marl.—All production in 1954 was refined and sold for water-conditioning, industrial, and agricultural purposes. As in previous years, output was obtained from the open-pit operations of the Inversand Co., Sewall; Permutit Co., Birmingham; and Zeolite Chemical Co., Reeve's Station.

TABLE 4.—Greensand marl sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	6,372	$401,064	1952	4,600	177,847
1950	3,935	304,321	1953	6,821	193,404
1951	5,067	263,944	1954	2,101	184,834

[4] New Jersey Zinc Co., Zinc: April 1955, p. 2.
[5] Brick & Clay Record, A Visit to the World's Most Modern Brick Plant; August 1955, pp. 29–32.

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Lime.—The Lime Crest plant of Limestone Products Corp. of America, Sussex County, and Peapack Limestone Quarry, Inc., Somerset County, were the only producers of burnt lime in New Jersey in 1954. Output consisted of hydrated lime for building, agricultural, chemical, and industrial uses.

Perlite.—Crude perlite from the southwestern United States was expanded and sold for use as plaster and concrete aggregate by Certified Industrial Products, Inc., Essex County; Coralux Perlite Corp. of New Jersey, Middlesex County; and PerAleX of New Jersey, Inc., Passaic County.

Pigments.—Iron oxide pigments were produced in New Jersey by E. I. du Pont de Nemours & Co., Essex County; Stabilized Pigment Co., Middlesex County; and Binney & Smith, Inc., Mercer and Middlesex Counties. Output of these four plants consisted of black, brown, red, and yellow iron oxides.

Sand and Gravel.—New Jersey sand and gravel output increased 36 percent in tonnage in 1954 compared with the previous year. The number of commercial producers reporting to the Bureau of Mines rose from 55 in 1953 to 95 in 1954. Major producers in 1954 were New Jersey Silica Sand Co., Cumberland County; Crossman Co., Middlesex County; and Bennett Sand & Gravel Co., Inc., Monmouth County. The principal sand-and-gravel-producing counties were Cumberland and Morris.

In 1954 all output was obtained from commercial operations, whereas in 1953 production included commercial and noncommercial. New Jersey sand and gravel was used primarily for structural (43 percent), paving (25 percent), and molding (14 percent) uses. There was also a substantial output of ground sand by National Pulverizing Co. and Penna. Glass Sand Corp., Cumberland County; South River Sand Co., Middlesex County; and New Jersey Pulverizing Co.,

TABLE 5.—Sand and gravel sold or used by producers, 1953–54, by classes of operations and uses

Uses	1953		1954	
	Short tons	Value	Short tons	Value
Sand:				
Glass	845,893	$2,073,653	658,726	$1,815,581
Molding	1,460,431	3,706,154	1,362,920	3,195,493
Structural	1,685,347	1,319,946	2,713,056	2,506,220
Paving	1,184,098	1,067,913	1,952,931	1,702,822
Blast sand	59,310	206,555	121,912	465,938
Fire or furnace	16,742	28,859	(1)	(1)
Engine	12,230	8,101	(1)	(1)
Filter	92,277	137,603	(1)	(1)
Other sand	382,257	389,521	[2] 710,429	[2] 1,689,567
Gravel:				
Structural	1,003,602	1,168,799	1,603,660	2,475,957
Paving	591,847	674,933	562,041	559,163
Railroad ballast	11,398	13,057	(1)	(1)
Other gravel	16,503	40,854	205,775	147,127
Undistributed			113,875	146,606
Total sand and gravel	7,361,935	10,835,948	10,005,325	14,704,474

[1] To avoid disclosure of individual company data, figures are included with "Undistributed."
[2] Includes ground sand.

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TABLE 6.—Stone sold or used by producers, 1953–54, by uses

Uses	1953		1954	
	Short tons	Value	Short tons	Value
Crushed and broken stone:				
Riprap	85, 910	$155, 521	93, 818	$186, 472
Crushed stone	5, 589, 373	11, 429, 660	5, 196, 925	9, 966, 349
Fluxing	(1)	(1)	5, 761	14, 915
Agricultural	(1)	(1)	120, 030	412, 131
Other	[2] 245, 844	[2] 1, 339, 217	[3] 355, 666	[3] 1, 530, 083
Undistributed	115, 132	383, 458		
Total	6, 036, 259	13, 307, 856	5, 772, 200	12, 109, 950

[1] Included with "Undistributed" to avoid disclosure of individual company operations.
[2] Excludes limestone for cement and lime.
[3] Other includes "terrazzo."

Ocean County. Production of these 4 operations totaled 107,000 tons and was used primarily for foundry use and refractory purposes. Ground sand was also used in abrasive, enamel, glass, pottery, porcelain, and tile manufacture.

Stone.—Basalt, granite, marble, and limestone were produced in New Jersey in 1954. Production declined 4 percent compared with the previous year. Of the nine counties from which stone output was reported, Passaic and Somerset were the largest. These 2 counties were responsible for 73 percent of total stone output. No dimension stone was produced in New Jersey in 1954. Concrete and roadstone, consisting mostly of basalt, was the major use, with 88 percent of total production. There were 14 basalt, 5 limestone, and 3 granite quarries and 1 marble quarry active in 1954. Of these, the Somerset County operation of North Jersey Quarry Co. and Samuel Braen & Sons Passaic County quarry were the largest.

Sulfur.—Sulfur paste and sludge, brimstone, and hydrogen sulfide were recovered as byproducts in the liquid purification of gas in New Jersey in 1954. Sulfur paste and sludge were obtained by the Thylox process at the Public Service Electric & Gas Co. Camden and Harrison plants in Camden and Hudson Counties, respectively. Koppers Co., Inc., and the Esso Standard Oil Co. produced hydrogen sulfide at their Seaboard and Bayway refineries, respectively. The Koppers Co. utilized the hot-vacuum-actification process, and the Esso Standard Oil Co. utilized the Girbotol process. Freeport Sulfur Co., Eagle Point, Gloucester County, recovered brimstone from gas by use of the modified Baehr process.

Vermiculite.—Vermiculite Industrial Corp., Newark, Essex County; Zonolite Co., Trenton, Mercer County; and F. E. Schundler & Co., Inc., South Kearny, Hudson County, produced exfoliated vermiculite from material imported from Montana. Output was sold for insulation, and plaster and concrete aggregate.

MINERAL FUELS

Peat.—Peat for soil improvement, mixed fertilizers, and concrete curing purposes was recovered in Sussex County in 1954.

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TABLE 7.—Value of mineral production in New Jersey, 1953–54, by counties

County	1953	1954	Minerals produced in 1954 in order of value
Atlantic	(1)	$181,018	Sand and gravel.
Bergen	$959,050	1,296,533	Sand and gravel, clays.
Burlington	337,166	705,329	Sand and gravel, greensand, clays.
Camden	890,809	782,481	Sand and gravel, clays, recoverable sulfur.
Cape May	1,956,136	1,817,011	Magnesium compounds, sand and gravel.
Cumberland	6,159,372	6,169,847	Sand and gravel, clays.
Essex	529,913	(1)	Stone.
Gloucester	(1)	624,978	Sand and gravel, recoverable sulfur, greensand.
Hudson	(1)	(1)	Clays, sulfur.
Hunterdon	(1)	63,378	Stone.
Mercer	531,742	(1)	Sand and gravel.
Middlesex	1,800,719	1,812,523	Clays, sand and gravel, stone.
Monmouth	619,955	896,665	Sand and gravel, clays.
Morris	9,895,465	6,987,949	Iron ore, sand and gravel, stone, clays.
Ocean	661,637	820,056	Sand and gravel.
Passaic	4,893,717	5,111,986	Stone, sand and gravel, iron ore, clays.
Salem	(1)	(1)	Sand and gravel.
Somerset	4,108,468	4,070,564	Stone, sand and gravel, lime.
Sussex	14,759,494	12,283,472	Zinc, manganiferous residuum, stone, lime, peat, sand and gravel.
Union	1,723,164	685,301	Stone.
Warren	1,778,494	1,970,217	Iron ore, sand and gravel, stone, clays.
Undistributed	339,846	764,420	
Total	51,945,000	47,044,000	

[1] Included with "Undistributed."

REVIEW BY COUNTIES

Atlantic.—The only mineral commodity produced in Atlantic County in 1954 was sand and gravel. Output was obtained mostly from land operations, although there were three dredges active. Production was utilized for building, paving, molding, and miscellaneous uses. Producers were Absecon Island Sand Co., Oceanville; Atlantic Sand & Gravel Co., Reega; Tri-State Sand Co., Cedar Lake; Ida M. Cunningham, Egg Harbor Township; Dominic Macrie, Folsom; J. F. Gandy, Marmora; F. Gallingani, Pleasantville; Somers Point Washed Sand Co., Somers Point; Taggert Brimfield Co., Cedar Lake; and Edwin H. Warner, Pleasantville.

Bergen.—Sand and gravel and clays were produced in Bergen County in 1954. The county ranked third in value of sand and gravel output in the State. Output was sold primarily for structural purposes. Producers active in 1954 were Braen Sand & Gravel Co., Wyckoff; Samuel Braen & Co., Mahwah; Bross Sand & Gravel Co., Inc., Paramus; Leonard Combee, Glen Rock; E. M. DiMaggio, Paramus; McKee Bros., Inc., Mahwah. The Bross Sand & Gravel Co., Inc., ceased operations on July 31, 1954, as a result of exhaustion of the sand and gravel deposit. Common clays for heavy clay products were produced by Hackensack Brick Co., Little Ferry; and Tri-County Brick Corp., Moonachie. Kingsland Clay Products Co. closed its open-pit mine near Lyndhurst during the year. Clays for use in manufacture of heavy clay products were purchased by this company from mines in Pennsylvania and New Jersey.

Burlington.—The Permutit Co. and Zeolite Chemical Co. operated greensand-marl surface mines near Birmingham and Reeve's Station, respectively, in 1954. Output was sold for water-conditioning and agricultural purposes. Sand and gravel was produced by Amico Sand & Gravel Co., Riverside; Lockhart, Inc., East Riverton; George F. Pettinos, Inc., Mount Holly; H. R. Sherman, Burlington; and

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Whitehead Bros. Co., Mount Holly. The Amico Sand & Gravel Co. operated two dredges on the Delaware River. One was in dry-dock for the first 3 months of the year. Heavy clay products were produced from clays mined by Church Brick Co., Fieldsboro; and Graham Brick Mfg. Co., Maple Shade. Fire clay for foundries and steel works was mined by the Burlington Clay & Engineering Co., Burlington.

Camden.—Dredges operated by Bridgeton Sand Co., Winslow Junction; Chews Landing Sand & Stone Co., Inc., Chews Landing; Pine Valley Sand Wash, Pine Hill; Reading Sand Co., Winslow Junction; and Russell W. Ward, Inc., Palmyra, produced sand and gravel in 1954 for building, paving, molding, and miscellaneous uses. Miscellaneous clays were produced from an open-pit mine by Alliance Clay Product Co., Winslow Junction, for use in manufacturing heavy clay products. Public Service Electric & Gas Co., Camden, produced flotation sulfur paste from gases by use of the Thylox process at its Camden coke plant in 1954. The company also treated material shipped from the company Harrison gas works in Hudson County.

Cape May.—Refractory magnesia from sea water and dolomite was the major mineral commodity produced in Cape May County in 1954 in point of value. This commodity was obtained from the Cape May plant of the Northwest Magnesite Co. Building and paving sand and gravel were produced by Courtland Sand & Gravel Co., Swainton; Menantico-Tuckahoe Sand & Gravel Co., Tuckahoe; and Seaville Sand & Gravel Co., Inc., Cape May. Seaville Sand & Gravel Co., Inc., and Menantico-Tuckahoe Sand & Gravel Co. both operated lake dredges. Menantico-Tuckahoe Sand & Gravel Co. had been operated under the name of Albino Vendrasco until June 31, 1954, when the company was incorporated.

Cumberland.—Cumberland County in 1954 continued to rank as the third largest mineral-producing area in value of output in New Jersey and was the largest sand-and-gravel-producing county. Output was utilized for molding, glass, blast, engine, and filter sands, as well as for structural and paving material. Producers were Armstrong Cork Co., South Vineland; Brunetti Bros., Vineland; Diamond Sand & Stone Co., South Vineland; Daniel Goff Co., Inc., Menantico-Tuckahoe Sand & Gravel Co., New Jersey Silica Sand Co., George F. Pettinos, Inc., Millville; Millville Silica Sand & Gravel Co., Inc., Port Elizabeth; Jesse S. Morie & Son, Inc., Mauricetown; and Whitehead Bros., Dividing Creek and Dorchester. The Daniel Goff Co., Inc., also operated a fire-clay mine near Millville.

Essex.—M. L. Kernan, South Orange, and Orange Quarry Co., West Orange, produced crushed and broken traprock for concrete aggregate and road stone in Essex County in 1954. Certified Industrial Products, Inc., Hillside, produced expanded perlite. Vermiculite Industrial Corp., Newark, and F. E. Schundler & Co., Inc., South Kearny, operated vermiculite exfoliating plants in Essex County in 1954.

Gloucester.—Molding, structural, paving, and furnace sands were produced in Gloucester County in 1954 by L. R. Curtis, Bridgeport; Downer Silica Co., Downer; George F. Pettinos, Inc., Washington;

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F. R. Warner, Inc., Bridgeport; and Wenonah Sand & Gravel Co., Mount Royal. Inversand Co. operated a surface mine 2 miles from Sewell for producing greensand marl. This commodity was sold for water-treatment purposes. Sulfur was recovered by the modified Baehr process at the Eagle Point plant of Freeport Sulfur Co. near Westville.

Hudson.—Public Service Electric & Gas Co. operated its Harrison gas works during 1954 and recovered sulfur paste as a byproduct of gas production. The Koppers Co., Inc., produced hydrogen sulfide by hot-vacuum actification at its Seaboard plant near Kearny. Esso Standard Oil Co. transferred all operations from its Eagle works at Jersey City to its Bayonne, N. J., refinery. The Eagle works had been, at one time, the largest lubricating-oil plant in the world. Operations date from 1878, when the Eagle Oil Co. moved from Carbondale, Pa. Operations have been cut back gradually since 1929.

Hunterdon.—The only mineral commodity produced in Hunterdon County in 1954 was stone. Crushed basalt for use as concrete aggregate and road material was quarried at the Oldwick quarry of Preen Crushed Stone Co. Mulligan lime quarry at Clinton yielded crushed limestone for blast furnace flux, concrete aggregate, and road material. The Trimmer Stone Co. was idle during the year.

Mercer.—The only mineral operation in Mercer County in 1954 was the building sand and gravel pit of Crosswicks Sand & Gravel Co., Yardville. Exfoliated vermiculite was produced from crude material imported from the western United States by Zonolite Co., Trenton.

Middlesex.—Clay, sand and gravel, and stone were produced in Middlesex County in 1954. Fire clay, principally for refractory use, was produced by McHose Clay Co., Raritan Township; Natco Corp., Keasbey and New Brunswick; Sayre & Fisher Brick Co., Sayreville Clay Co., and Such Clay Co., all of Sayreville; Valentine Fire Brick Co., Woodbridge; Whitehead Bros. Co., Sayreville; and Marcus S. Wright, Inc., and William S. Wright, both of Milltown. Sand and gravel, predominantly for building and paving purposes, was produced by Crossman Co., Sayreville; Dallenbach Sand Co., Inc., South Brunswick Township; Glenn-Rock Concrete Products Co., Jamesburg; Raritan River Sand Co., Nixon; and Whitehead Bros. Co., Sayreville. The Coralux Perlite Corp. of New Jersey produced expanded perlite at its plant near Metuchen from material purchased in the southwestern part of the United States.

Monmouth.—Bennett Sand & Gravel Co., Inc., Manasquan; Benjamin Fary, Wayside; Hause Gravel Co., Allenwood; New Jersey Gravel & Sand Co., Farmingdale; Joseph Scarano, Wayside; Preston Bros., Perrineville; W. S. Van Hise, Belmar; and Walling & Son, Hazlet, produced sand and gravel for building, paving, filter, and mason use during 1954. Oschwald Brick Works, Inc., near Lawrence Harbor, operated an open-pit clay mine. Output was used in manufacturing building brick.

Morris.—The mines and quarries of Morris County yielded iron ore, sand and gravel, stone, and clays in 1954. The county ranked in second place dollarwise among the mineral-producing counties of the State. Iron ore was produced by Scrub Oak mine, Alan Wood Steel Co.; Richard Ore mine, Colorado Fuel & Iron Corp.; and Mount Hope

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mine, Warren Foundry & Pipe Corp. Morris County was the second largest sand-and-gravel-producing area in New Jersey. This commodity was produced by Consolidated Stone & Sand Co., Riverdale; Morris County Land Improvement Co., Whippany; North Jersey Quarry Co., Netcong; Pequannock Sand & Gravel Co., Pequannock; Seguine-Bogert Co., Inc., Kenvil; Wharton Sand & Stone Co., Montville; and Alan Wood Steel Co., Dover. Granite for concrete aggregate, road stone, railroad ballast, stone sand, and riprap was produced by Pompton Crushed Stone Co., Riverdale; Alan Wood Steel Co., Mine Hill; and Wharton Sand & Stone Co., Montville. A small quantity of miscellaneous clay for use in manufacturing flower pots was produced by Logansville Pottery Co., Basking Ridge.

Ocean.—The one mineral commodity produced in Ocean County in 1954 was sand and gravel from pits operated by Brown & Burdge Sand & Gravel Co., Herbertsville; Clayton's Sand & Gravel Co., Barnegat; Ralph Clayton & Sons, Lakewood; J. Kalsch & Son, Stafford Township; and North Jersey Quarry Co., South Lakewood. Most of the county output was used as building and paving material.

Passaic.—Passaic County ranked fourth in value of mineral output in New Jersey in 1954 and was the county with largest stone production. County mines and quarries yielded stone, sand and gravel, iron ore, and clays. Stone producers consisted of Samuel Braen & Sons, Hawthorne and Haledon; Consolidated Stone & Sand Co., Montclair Heights; Great Notch Corp., Great Notch; Sowerbutt Quarries, Inc., Paterson; and the Union Building & Construction Corp., Clifton. The output was used principally for concrete aggregate and road stone, although a substantial tonnage was sold to roofing-granule producers. Iron ore was obtained from the Peters mine of Ringwood Iron Mines, Inc., near Wanaque, until May 1, when operations ceased. Shaft sinking continued, however, until September 1, when the mine and mill were placed on a caretaker basis until the ore market improved. Samuel Braen's Sons, Pequannock; H. J. Hinchman & Sons and Van Decker Bros., Inc., both of Wayne Township; and the Van Orden Sand & Gravel Co., Preakness, produced sand and gravel in Passaic County in 1954. Paterson Brick Co., Inc., operated an open-pit clay mine near Little Falls in 1954. Output was used in the production of building brick. Expanded perlite was produced from material imported from the southwestern United States by PerAleX of New Jersey, Inc., in its Paterson plant.

Salem.—A. W. Davis Lumber Co., Quinton Township, and Flora S. Richman, Woodstown, produced sand in Salem County in 1954 for building and paving purposes.

Somerset.—Somerset County produced the second largest output of stone in New Jersey in 1954. This commodity was produced by Fanwood Stone Crushing Quarry Co., Westfield; North Jersey Quarry Co., Bound Brook and Millington; and Somerset Crushed Stone, Inc., Bernardsville. The output consisted of crushed and broken basalt for concrete aggregate, road stone, riprap, and railroad ballast. Johns-Manville Corp., Manville, manufactured precipitated magnesium carbonate for use as insulation from dolomite rock. Sand and gravel was produced in Somerset County in 1954 by John W. Allen, Martinsville; Edward Murdock, Somerset; and Trimmer Lumber

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Co. Peapack Limestone Quarry, Inc., Peapack, produced hydrated lime in Somerset County.

Sussex.—Sussex County ranked as the major mineral-producing area in New Jersey. Zinc, manganiferous residuum, stone, sand and gravel, lime, and peat were produced by the mines and quarries of the county. Zinc and byproduct manganiferous residuum were recovered from ores mined at the Franklin and Sterling Hill mines of the New Jersey Zinc Co. The Franklin mine was closed permanently on October 1, 1954, because of exhaustion of the ore body. The open quarries of Limestone Products Corp. of America, Newton, and Farber White Limestone Co., Ogdensburg, yielded limestone for riprap, blast-furnace flux, concrete aggregate, road material, agricultural stone, rubber filler, poultry house and barn floors, and mineral feeds. Limestone Products Corp. of America operated its Lime Crest plant during 1954 to produce hydrated lime. The output was sold for building, agricultural, water-purification, and water-softening purposes. This company also produced sand and gravel, as did F. W. Bennett & Son Co., Sparta.

Union.—The only mineral producer in Union County was the North Jersey Quarry Co. near Summit. This open quarry yielded a crushed basalt for concrete aggregate and road stone.

Warren.—Iron ore, sand and gravel, stone, and clays were produced in Warren County in 1954. Alan Wood Steel Co. Washington mine near Oxford was the only producer of iron ore. Sand and gravel was produced by H. W. Folkner, Buttzville; The Estate of Gabor J. Horvath, Harmony; Portland Sand & Gravel Co., Carpentersville; Steckel Concrete Co., Phillipsburg; and Harvey Stevens, Great Meadows. Warren County was the only area in New Jersey in which marble was produced. This commodity came from the open quarry of The Royal Green Marble Co., Inc., near Phillipsburg. The output was crushed for terrazzo. Natco Corp. operated an open-pit clay mine near Port Murray. J. T. Baker Chemical Co. produced magnesium compounds at its plant near Phillipsburg from purchased magnesium carbonate.

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The Mineral Industry of New Mexico

By Frank J. Kelly,[1] William H. Kems,[1] Breck Parker,[1] and Alfred L. Ransome[2]

CONTINUED advances in output of most of New Mexico's principal minerals in 1954 raised the total value of the State mineral production 11 percent to a record high figure of $373.6 million compared with the previous record of $336.6 million in 1953. Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

Petroleum, natural gas, and natural-gas liquids, together with potassium salts, furnished 86 percent of the total value in 1954; the gains for these commodities together more than offset the decreases for other minerals and were largely responsible for the overall increase over 1953. In contrast, production and value of copper, lead, and zinc declined in 1954. Lead output was the lowest in 33 years, and for the first time since 1903 no zinc or lead-zinc ore was mined.

Crude-petroleum-production value increased 11, natural gas 44, natural gasoline 16, and liquefied-petroleum gases 24 percent over 1953, and all 4 established new records for both quantity and value. New Mexico ranked seventh among the States in value of petroleum production. There were eight refineries in the State in 1954, but a large part of the crude oil produced continued to be refined in other States.

Among the nonmetals produced in New Mexico, potash was by far the most important. Both production and shipments of potash again established new records. The 5 mines in New Mexico furnished 90 percent of the total United States production of potash in 1954.

Metals contributed only 10 percent of the total value of all minerals produced in New Mexico in 1954, compared with 14 percent in 1953. Although copper, as heretofore, ranked first among metals by a wide margin, output decreased 16 percent in quantity owing largely to curtailment of operation, from a 7-day to a 5-day workweek for a 7-month period, at the large Chino open-pit mine in Grant County. Lead output in 1954 decreased 70 percent from 1953, and zinc production was only 6 tons compared with 13,373 tons in 1953.

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Gypsum sales were reported in 1954 for the first time since 1949, and hand-cobbed and full-trimmed mica and tungsten were reported as produced in 1954, compared with no output in 1953.

Uranium mining and exploration continued to center in McKinley, Valencia, and San Juan Counties. A new uranium mill at Shiprock started operation, and a mill at Bluewater was being constructed.

In addition to the mineral values credited to New Mexico in table 1, some are omitted owing to lack of information.

Many ores contain valuable minor constituents, such as arsenic, bismuth, cadmium, cobalt, nickel, platinum-group metals, selenium, tellurium, and some minor metals, such as gallium and germanium. The quantities of these elements sometimes are not known and sometimes, though known by analyses, are not accounted for metallurgically in early processing stages or credited to the mine of origin. These minor constituents are recovered at plants that frequently treat

TABLE 1.—Mineral production in New Mexico, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Beryllium concentrate—gross weight	89	$52,014	117	$43,771
Clays	49,089	103,931	47,832	83,085
Coal	513,781	3,081,366	123,099	727,372
Columbium-tantalum concentrate—pounds, gross weight	(2)	(2)	2,093	3,558
Copper (recoverable content of ores, etc.)	72,477	41,601,798	60,558	35,729,220
Fluorspar	11,890	(2)	8,876	(2)
Gypsum			887	2,661
Gold (recoverable content of ores, etc.)—troy ounces	2,614	91,490	3,539	123,865
Helium (shipments)—cubic feet	11,158,000	150,127	41,754,600	735,183
Iron ore (usable)—long tons, gross weight	7,525	(2)	3,316	(2)
Lead (recoverable content of ores, etc.)	2,943	771,066	887	243,038
Manganiferous ore (5 to 35 percent Mn)—gross weight	(2)	(2)	20,546	82,184
Mica (sheet)—pounds			[3] 2,054	13,845
Natural gas—million cubic feet	399,086	24,344,000	449,346	35,049,000
Natural-gas liquids:				
Natural gasoline and cycle products—thousand gallons	171,654	10,094,000	224,112	11,744,000
LP-gases—do	121,212	4,618,000	225,994	5,704,000
Perlite	84,891	661,698	111,040	885,824
Petroleum (crude)—thousand 42-gallon barrels	70,441	185,260,000	[4] 74,820	[4] 205,760,000
Potassium salts—K_2O equivalent	1,552,831	[5] 58,076,435	1,732,240	64,366,641
Pumice and pumicite	528,649	759,840	363,926	1,060,096
Salt (common)	62,087	216,364	50,669	333,255
Sand and gravel	1,416,380	1,238,979	6,519,339	8,340,251
Silver (recoverable content of ores, etc.)—troy ounces	205,309	185,815	109,132	98,770
Stone	624,528	510,713	771,630	714,037
Tungsten concentrate—60-percent WO_3 basis			(6)	1,414
Zinc (recoverable content of ores, etc.)	13,373	3,075,790	6	1,296
Undistributed: Barite, carbon dioxide, diatomite (1953–54), gem stones, gypsum (1954), molybdenum, recovered elemental sulfur (1953–54), vanadium, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2)		1,686,990		1,752,422
Total New Mexico		[5] 336,580,000		373,599,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers); excludes uranium and value of low-grade manganese or eshipped to General Services Administration Purchase Depots.
[2] Value included with "Undistributed."
[3] Hand-cobbed equivalent, 23 short tons.
[4] Final figure. Supersedes preliminary figure given in commodity chapter.
[5] Revised figure.
[6] Less than 1 ton.

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mixtures of materials from many sources, including residues from the refining of such metals as copper and lead, and in other ways. In many such instances it is impossible to allot the mineral products to States of origin, and sometimes it is even difficult to obtain an accurate separation as to domestic and foreign sources. Another valuable mineral that usually cannot be separated as to source is byproduct sulfuric acid.

The Government, through the Defense Minerals Exploration Administration (DMEA), continued to aid in financing exploration in search of strategic and critical minerals. The projects undertaken in New Mexico during 1954 are listed in table 3. It is significant that, of the 4 projects, 3 were for uranium, 1 was for manganese, and none were for copper, lead, zinc, or tungsten, as was the case in 1951–53.

TABLE 2.—Average prices of certain mineral commodities in New Mexico, 1953–54 [1]

Commodity		1953	1954
Beryl	short ton	$584.427	$374.111
Clays	do.	2.117	1.737
Coal	do.	6.000	5.909
Copper [2]	pound	.287	.295
Gold [3]	troy ounce	35.000	35.000
Helium	cubic foot	.013	.018
Lead [2]	pound	.131	.137
Mica (hand-cobbed)	do.		6.740
Perlite (crude)	short ton	7.795	7.978
Petroleum [4]	42-gallon barrel	2.630	2.750
Potassium salts K_2O equivalent	short ton	[5] 37.400	37.158
Pumice	do.	1.437	2.913
Salt	do.	3.485	6.577
Sand and gravel	do.	.875	1.279
Silver [6]	troy ounce	.905+	.905+
Stone	short ton	.817	.925
Zinc [2]	pound	.115	.108

[1] Prices are based on average value f. o. b. mines or mills reported by the producers, except as otherwise noted.
[2] Yearly average weighted price of all grades of primary metal sold by producers
[3] Price under authority of Gold Reserve Act of Jan. 31, 1934.
[4] Value at wells.
[5] Revised figure.
[6] Treasury buying price for newly mined silver July 1, 1946, to date—$0.9050505 ($0.905 used in 1947 for calculating purposes).

TABLE 3.—Defense Minerals Exploration Administration contracts in 1954

Contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
Flattop Mining Co.	Flattop and Vilatie claims.	Uranium	May 10, 1954	$8,032	90
Four Corners Exploration Co.	do.	do.	May 10, 1954	12,189	90
Southwest Manganese	Manganese Valley mine.	Manganese	Feb. 1, 1954	60,000	75
Uranium Development Corp.	UDC group	Uranium	Jan. 8, 1954	11,641	90
Total				91,862	80

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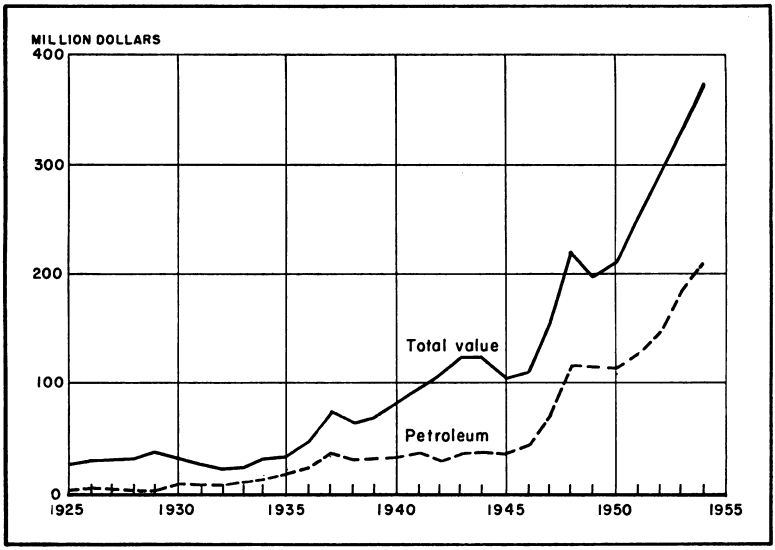

FIGURE 1.—Value of petroleum production and total value of all minerals in New Mexico, 1925–54.

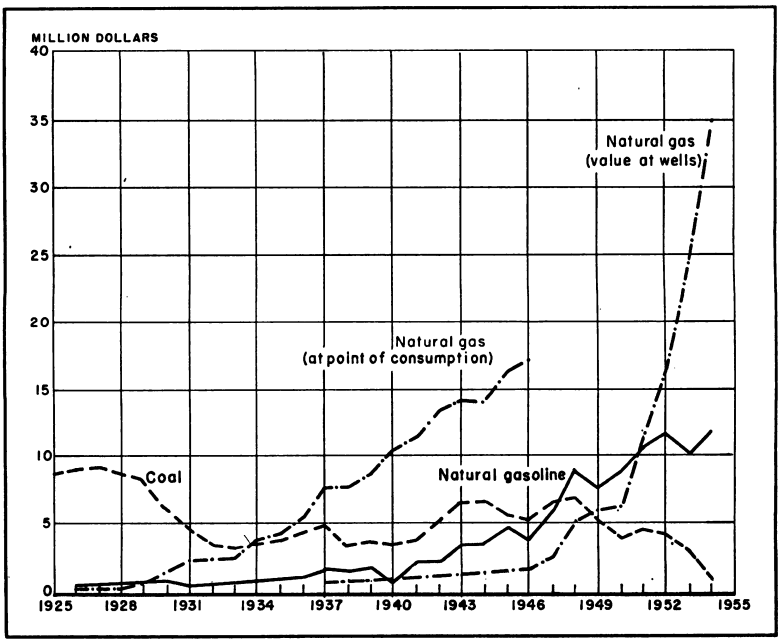

FIGURE 2.—Value of natural gas, natural gasoline, and coal in New Mexico, 1925–54.

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REVIEW BY MINERAL COMMODITIES

METALS

Beryl.—The output of beryl from New Mexico in 1954 came mainly from the Harding mine near Dixon, Taos County, the principal beryl-producing mine in the United States. Other smaller producers of beryl were the Apache mine near Petaca, Rio Arriba County, and the Old Priest mine near Ribera, San Miguel County. The beryl was recovered from pegmatite by simple hand sorting and marketed at the Custer, S. Dak., Government Purchase Depot, and at the Beryl Ores Co., Arvada, Colo.

Columbite-Tantalite.—Production of columbite-tantalite was reported from mines in Rio Arriba and San Miguel Counties. It was recovered from pegmatites as a coproduct of beryl and mica. Shipments were made mainly to the Custer, S. Dak., Government Purchase Depot. Sales in 1954 remained at the same level as that reported in 1953 owing to the assured market at Custer. The price during the year was stationary at $1.70 per pound for a combined pentoxide of 50-percent columbium-tantalum.

Copper.—The production of copper in New Mexico dropped 12,000 short tons and $6 million in 1954, compared with 1953. The reduction was due primarily to curtailment of operations at the Kennecott Copper Corp., Chino Mines Division, Chino open-pit mine at Santa Rita, Grant County, from a 7- to a 5-day workweek for the 7-month period March through September. This curtailment was effected by the company because of the world surplus of copper at the beginning of 1954 and anticipated added production capacity at several new large mines. In addition, a labor strike for higher wages and other benefits at the company operations between August 16 and September 1 curtailed the production of copper for 1954. During the last quarter of the year, the worldwide demand for copper exceeded supply, and the Office of Defense Mobilization released 40,000 tons of stockpile copper to domestic consumers. The monthly average price for domestic copper rose from 29.67 cents per pound in January 1954 to 29.70 cents in April, where it remained for the rest of the year. The weighted yearly average price in 1954 ($0.295 a pound) was the highest since 1872.

Most of the copper output came from Chino open-pit mine, Grant County. Other substantial producers were Banner Mining Co. Miser's Chest group and the Atwood Mines, Inc., Atwood mine near Lordsburg, Hidalgo County, and the Drunzer & Casner Stauber mine in the Pintado district, Guadalupe County.

Gold—Gold production rose to the highest level (3,539 fine ounces) since 1951 after having declined in 1953 to the lowest level (2,614 ounces) in 85 years. Of the gold recovered, 90 percent came from copper ore from 18 mines. The remaining 10 percent came from small tonnages of gold, gold-silver, and lead ore from 19 mines and from gravel from 4 placer operations. The increased gold output in 1954, despite a 16-percent reduction in copper production, was due mainly to declining demand for fire-refined copper from the Chino Mines Division of Kennecott Copper Corp. refinery at Hurley (from which process no gold and silver are recovered), which caused the company to

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market a larger quantity of its product as blister copper for electrolytic refining (from which gold and silver are recovered).

TABLE 4.—Mine production of gold, silver, copper, lead, and zinc, 1945–49 (average), 1950–54, and total, 1848–1954, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945–49 (average)	69	3	7,012,785	3,884	$135,954	447,498	$380,401
1950	78	2	7,899,054	3,414	119,490	338,581	306,433
1951	83	3	8,670,489	3,959	138,565	443,267	401,179
1952	66	1	9,120,841	2,949	103,215	479,318	433,807
1953	55	2	8,070,056	2,614	91,490	205,309	185,815
1954	37	4	6,763,529	3,539	123,865	109,132	98,770
1848–1954			(3)	2,209,119	50,653,358	70,764,700	55,669,346

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	59,408	$22,211,837	6,250	$1,686,791	38,270	$9,413,450	$33,828,433
1950	66,300	27,580,800	4,150	1,120,500	29,263	8,310,692	37,437,915
1951	73,558	35,602,072	5,846	2,022,716	45,419	16,532,516	54,697,048
1952	76,112	36,838,208	7,021	2,260,762	50,975	16,923,700	56,559,692
1953	72,477	41,601,798	2,943	771,066	13,373	3,075,790	45,725,959
1954	60,558	35,729,220	887	243,038	6	1,296	36,196,189
1848–1954	1,889,484	655,303,945	314,376	41,022,091	1,098,927	199,862,452	1,002,511,192

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore, old tailings, or copper precipitates shipped to smelters during the calendar year indicated.
[2] Does not include gravel washed or tonnage of precipitates shipped.
[3] Figure not available.

TABLE 5.—Gold and silver produced at placer mines, 1945–49 (average) and 1950–54, in terms of recoverable metals

Year	Gold		Silver		Total value	Year	Gold		Silver		Total value
	Fine ounces	Value	Fine ounces	Value			Fine ounces	Value	Fine ounces	Value	
1945–49 (average)	18	$616	6	$5	$621	1952	2	$70	-------	-------	$70
1950	6	210	-------	-------	210	1953	5	175	2	$2	177
1951	4	140	-------	-------	140	1954	14	490	-------	-------	490

Iron Ore.—Because of declining demand for iron ore in manufacturing certain types of cement, 1954 sales were less than half the 1953 total. The Pearson iron pit on the Hanover-Bessemer property, Grant County, was the only active producer during the year. Magnetite, the principal iron mineral, was mined from an open pit by Mathis & Mathis, which leased the property from the United States Smelting, Refining & Mining Co.

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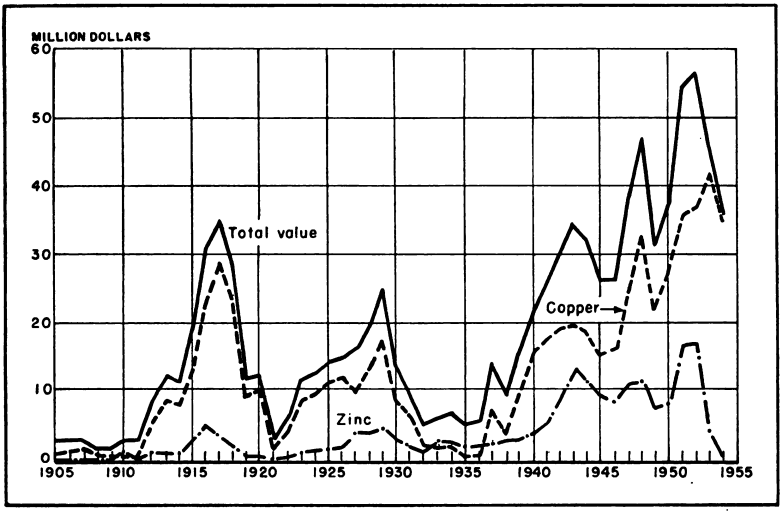

FIGURE 3.—Value of mine production of copper and zinc and total value of gold, silver, copper, lead, and zinc in New Mexico, 1905–54. The value of gold, silver, and lead produced annually has been relatively small.

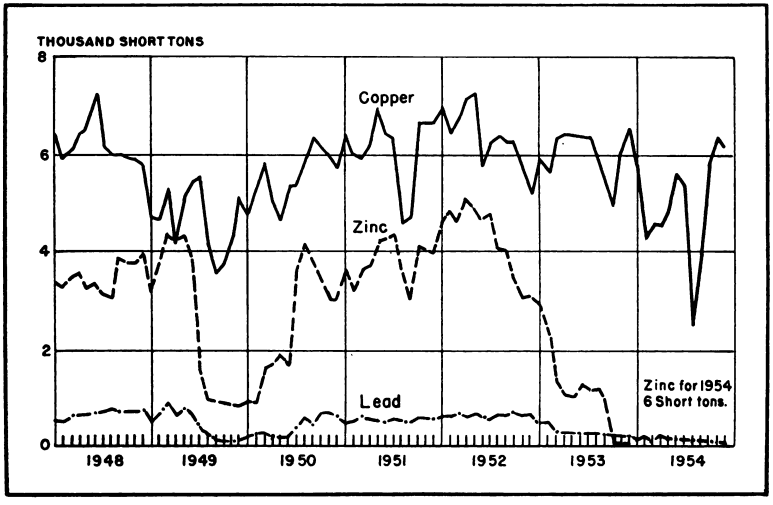

FIGURE 4.—Mine production of copper, lead, and zinc in New Mexico, by months, 1948–54, in terms of recoverable metals.

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TABLE 6.—Mine production of gold, silver, copper, lead, and zinc in 1954, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	440	13,248	5,752	83	1
February	518	15,056	4,249	130	1
March	242	7,607	4,564	85	1
April	364	7,312	4,498	157	1
May	465	11,010	4,792	83	----
June	565	11,435	5,564	90	1
July	574	10,758	5,344	57	1
August	73	7,010	2,514	49	----
September	40	6,604	4,960	50	----
October	149	6,423	5,843	51	----
November	58	6,370	6,298	46	----
December	51	6,299	6,180	6	----
Total	3,539	109,132	60,558	887	6

TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties, in terms of recoverable metals

County	Mines producing		Material sold or treated [1] (short tons)	Gold (lode and placer)		Silver (all lode)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
Catron	1	----	34	----	----	51	$46
Grant	14	3	6,607,942	3,126	$109,410	32,458	29,376
Guadalupe	1	----	7,673	----	----	----	----
Hidalgo	4	----	101,104	369	12,915	73,218	66,266
Lincoln	1	----	23	----	----	45	41
Luna	1	----	3	----	----	19	17
Otero	2	1	27	11	385	11	10
Santa Fe	2	----	96	16	560	88	80
Sierra	2	----	35	1	35	833	754
Socorro	7	----	46,586	16	560	2,401	2,173
Taos	1	----	5	----	----	6	5
Torrance	1	----	1	----	----	2	2
Total: 1954	37	4	6,763,529	3,539	123,865	109,132	98,770
1953	55	2	8,070,056	2,614	91,490	205,309	185,815

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Catron	----	----	----	----	----	----	$46
Grant	58,184	$34,328,560	14	$3,836	1	$216	34,471,398
Guadalupe	130	76,700	----	----	----	----	76,700
Hidalgo	2,218	1,308,620	23	6,302	----	----	1,394,103
Lincoln	----	----	3	822	----	----	863
Luna	----	----	----	----	----	----	17
Otero	1	590	----	----	----	----	985
Santa Fe	4	2,360	----	----	----	----	3,000
Sierra	----	----	----	----	----	----	789
Socorro	21	12,390	847	232,078	5	1,080	248,281
Taos	----	----	----	----	----	----	5
Torrance	----	----	----	----	----	----	2
Total: 1954	60,558	35,729,220	887	243,038	6	1,296	36,196,189
1953	72,477	41,661,798	2,943	771,066	13,373	3,075,790	45,725,959

[1] Does not include gravel washed or tonnage of precipitates shipped.

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TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1954, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines[1]	Material sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold	3	120	217	118	500	1,400	----------
Dry gold-silver	1	3	1	20	----------	200	----------
Dry silver	7	71	4	1,640	500	----------	----------
Total	11	194	222	1,778	1,000	1,600	----------
Copper	18	[2] 6,708,360	3,176	103,792	[3] 92,771,300	46,300	----------
Lead	8	[4] 45,200	21	2,052	4,700	1,725,500	12,000
Total	25	6,753,560	3,197	105,844	92,776,000	1,771,800	12,000
Other "lode" material:							
Old tailings, etc.[5]	----------	9,775	106	1,510	31,900	600	----------
Copper precipitates	1	17,569	----------	----------	28,307,100	----------	----------
Total	1	27,344	106	1,510	28,339,000	600	----------
Total "lode" material	37	6,781,098	3,525	109,132	121,116,000	1,774,000	12,000
Gravel (placer operations)	4	----------	14	----------	----------	----------	----------
Total, all sources	41	6,781,098	3,539	109,132	121,116,000	1,774,000	12,000

[1] Detail will not necessarily add to totals because some mines produce more than 1 class of material.
[2] Includes 10,400 tons of newly mined ore treated by heap leaching.
[3] Includes 118,800 pounds of copper recovered from precipitates obtained from newly mined ore treated in a heap-leaching plant.
[4] Includes 25,330 tons of lead-barite ore yielding 695 tons of lead concentrate averaging 52 percent lead and 7,102 tons of barite.
[5] Includes 30 tons silver mill cleanings, 992 tons gold-silver tailings, and 8,753 tons copper tailings.

TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Material treated (short tons)	Recoverable metals				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:						
Amalgamation:						
Ore	[1]	48	12	----------	----------	----------
Mill cleanup	30	----------	32	----------	----------	----------
Total	30	48	44	----------	----------	----------
Concentration and smelting of concentrates:						
Ore	6,663,684	2,988	81,870	91,269,200	1,600,500	10,000
Old tailings (copper)	8,753	----------	----------	21,500	----------	----------
Total	6,672,437	2,988	81,870	91,290,700	1,600,500	10,000
Direct smelting:						
Ore	90,070	383	25,740	1,507,800	172,900	2,000
Old tailings (gold-silver)	992	106	1,478	10,400	600	----------
Copper precipitates	17,569	----------	----------	28,307,100	----------	----------
Total	108,631	489	27,218	29,825,300	173,500	2,000
Placer	[2]	14	----------	----------	----------	----------
Grand total	[3] 6,781,098	3,539	109,132	121,116,000	1,774,000	12,000

[1] Less than 1 ton.
[2] Not available.
[3] Excluding placer gravel.

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TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals

A. For material treated at mills

	Material treated (short tons)	Recoverable in bullion		Concentrate shipped to smelters and recoverable metals					
		Gold (fine ounces)	Silver (fine ounces)	Concentrate (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES									
Catron	30		32						
Grant	[1] 6,555,211	48	12	193,115	2,793	30,157	[2] 87,262,500		
Hidalgo	72,565			7,312	195	51,544	4,028,000		
Socorro	[3] 44,661			1,499		169	200	1,600,500	10,000
Total: 1954	6,672,467	48	44	201,926	2,988	81,870	91,290,700	1,600,500	10,000
1953	7,961,301	266	107	249,436	1,424	159,756	114,578,246	5,636,290	26,738,510
BY CLASSES OF MATERIAL TREATED									
Dry gold	[4]	48	12						
Silver mill cleanup	30		32						
Copper:									
Ore	[1] 6,619,023			200,379	2,988	81,701	[2] 91,269,000		
Old tailings	8,753			48			21,500		
Lead	[3] 44,661			1,499		169	200	1,600,500	10,000
Total 1954	6,672,467	48	44	201,926	2,988	81,870	91,290,700	1,600,500	10,000
BY CLASSES OF CONCENTRATE SHIPPED TO SMELTERS									
Copper				200,427	2,988	81,701	[2] 91,290,500		
Lead				1,499		169	200	1,600,500	10,000
Total: 1954				201,926	2,988	81,870	91,290,700	1,600,500	10,000
1953				249,436	1,424	159,756	114,578,246	5,636,290	26,738,510

B. For material shipped directly to smelters

	Material shipped (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Catron	4		19			
Grant	70,300	281	2,289	29,105,500	28,000	2,000
Guadalupe	7,673			260,000		
Hidalgo	28,539	174	21,674	408,000	46,000	
Lincoln	23		45		6,000	
Luna	3		19			
Otero	27	1	11	2,000		
Santa Fe	96	16	88	8,000		
Sierra	35	1	833			
Socorro	1,925	16	2,232	41,800	93,500	
Taos	5		6			
Torrance	1		2			
Total: 1954	108,631	489	27,218	29,825,300	173,500	2,000
1953	125,749	919	45,444	30,375,754	249,710	7,490

[1] Includes 10,400 tons of newly mined ore treated by heap leaching.
[2] Includes 118,800 pounds of copper recovered from 117 tons of precipitates obtained from 10,400 tons of newly mined ore treated by heap leaching.
[3] Includes 25,330 tons of lead-barite ore yielding 695 tons of lead concentrate, averaging 52 percent lead, and 7,102 tons of barite.
[4] Less than 1 ton.

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TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of recoverable metals—Continued

B. For material shipped directly to smelters—Continued

	Material shipped (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY CLASSES OF MATERIAL						
Dry gold	120	169	106	500	1,400	
Dry gold-silver:						
Ore	3	1	20		200	
Old tailings	992	106	1,478	10,400	600	
Dry silver	71	4	1,640	500		
Copper:						
Ore	89,337	188	22,091	1,502,300	46,300	
Precipitates	17,569			28,307,100		
Lead	539	21	1,883	4,500	125,000	2,000
Total 1954	108,631	489	27,218	29,825,300	173,500	2,000

TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery (except placer) and classes of material processed, in terms of gross metal content

CONCENTRATE SHIPPED TO SMELTERS

Class of material	Quantity shipped or treated (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Copper	200,427	6,004	117,117	[1] 93,200,094		
Lead	1,499		169	249	1,703,127	11,014
Total: 1954	201,926	6,004	117,286	93,200,343	1,703,127	11,014
1953	249,436	7,395	230,127	117,017,641	5,965,220	28,203,438
ORE, ETC., SHIPPED DIRECTLY TO SMELTERS						
Dry gold	120	169	106	542	2,293	4,376
Dry gold-silver:						
Ore	3	1	20		284	
Old tailings	992	106	1,478	10,741	918	
Dry silver	71	4	1,640	1,253	301	107
Copper:						
Ore	89,337	238	22,534	1,848,129	77,010	
Precipitates	[2] 17,569			28,885,105		
Lead	539	21	1,883	7,012	127,956	2,232
Total: 1954	108,631	539	27,661	30,752,782	208,762	6,715
1953	125,749	969	46,002	31,400,823	336,309	29,325

[1] Includes 118,800 pounds of copper recovered from 117 tons of precipitates obtained from 10,400 tons of newly mined ore treated by heap leaching.
[2] Excludes 117 tons obtained from newly mined ore by heap leaching.

Lead.—The output of lead from New Mexico in 1954 (887 short tons) was the lowest since 1921 (339 tons). A Government-stockpile purchasing program to strengthen the price structure and bolster domestic production of lead and zinc was initiated in June but had little effect on the lead and zinc industry in New Mexico.

The leading producer of lead in 1953, Bayard group of lead-zinc mines of the United States Smelting, Refining & Mining Co. in the

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Central district, was placed on a complete shutdown basis on September 30, 1953, and remained inactive throughout 1954. The Ground Hog group of mines, the second-ranking producer in 1953, owned and operated by the American Smelting & Refining Co., was active during the first 2 months of 1953 but was closed during all of 1954.

Lead produced in New Mexico in 1954 came from several small shipments of ore from Grant County, copper ore shipped to the El Paso smelter from the Atwood mine in Hidalgo County, lead ore mined and milled at the Louise-Halstead-Hansonberg-Prairie Spring group and the Royal Flush mines in the Hansonberg district, Socorro County, copper ore from the Waldo mine, and lead ore from the Mistletoe and Queen group mines in the Magdalena district.

TABLE 12.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties and districts, in terms of recoverable metals [1]

County and district	Mines producing		Material sold or treated [2] (short tons)	Gold (fine ounces)		
	Lode	Placer		Lode	Placer	Total
Catron County:						
Mogollon	1		34			
Grant County:						
Central	7		6,606,815	3,003		3,003
Pinos Altos	4	3	1,005	111	4	115
Steeple Rock	1		104	8		8
Swartz	1		17			
White Signal	1		1			
Guadalupe County:						
Pintado	1		7,673			
Hidalgo County:						
Lordsburg	3		100,861	367		367
Sylvanite	1		243	2		2
Lincoln County:						
Red Cloud	1		23			
Luna County:						
Cooks Peak	1		3			
Otero County:						
Orogrande	1	1	19	1	10	11
Tularosa	1		8			
Santa Fe County:						
Cerrillos	1		75	12		12
San Pedro	1		21	4		4
Sierra County:						
Kingston	2		35	1		1
Socorro County:						
Hansonberg	2		44,661			
Magdalena	4		840	16		16
Scholle area	1		1,085			
Taos County:						
Picuris	1		5			
Torrance County:						
Carocito	1		1			
Total	37	4	6,763,529	3,525	14	3,539

See footnotes at end of table.

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TABLE 12.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties and districts, in terms of recoverable metals[1]—Continued

County and district	Silver (fine ounces),[2] Lode	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
Catron County:					
Mogollon	51				$46
Grant County:					
Central	30,426	116,356,400	10,300		34,459,191
Pinos Altos	1,643	11,000	2,000		9,031
Steeple Rock	52	500	1,400		667
Swartz	335		14,300	2,000	2,478
White Signal	2	100			31
Guadalupe County:					
Pintado		260,000			76,700
Hidalgo County:					
Lordsburg	73,098	4,419,000	45,900		1,388,895
Sylvanite	120	17,000	100		5,208
Lincoln County:					
Red Cloud	45		6,000		863
Luna County:					
Cooks Peak	19				17
Otero County:					
Orogrande	4	1,000			684
Tularosa	7	1,000			301
Santa Fe County:					
Cerrillos	43	4,000			1,639
San Pedro	45	4,000			1,361
Sierra County:					
Kingston	833				789
Socorro County:					
Hansonberg	169	200	1,600,500	10,000	220,561
Magdalena	2,232	30,700	93,500		24,446
Scholle area		11,100			3,274
Taos County:					
Picuris	6				5
Torrance County:					
Carocito	2				2
Total	109,132	121,116,000	1,774,000	12,000	36,196,189

[1] The report of this series for 1929 (chapter of Mineral Resources of the United States, 1929, pt 1, pp. 729–759) gives the yearly production of each important metal-producing district in New Mexico from 1904 to 1929, inclusive. Subsequent records, year by year, may be found in annual issues of Mineral Resources and Minerals Yearbook.
[2] Does not include gravel washed or tonnage of precipitates shipped.
[3] All from lode mines.

Manganese and Ferruginous Manganese Ores.—Because of curtailment of operations at the Pueblo, Colo., steel plant of Colorado Fuel & Iron Corp., the Boston Hill mine of Luck Mining & Construction Co. was shut down from February to July, and the output of ferruginous manganese ore fell to 21,000 tons. This segment of the State mineral industry is sensitive to the fluctuations in the steel industry because the only outlet for its product is the Pueblo steel plant. Southwest Manganese conducted exploration for manganese at the Manganese Valley mine, with the assistance of a Defense Minerals Exploration contract.

Shipments of manganiferous materials to Government purchase depots (not included in production data) rose from relative obscurity to a place of some importance in 1954. The value of shipments containing a minimum of 15-percent manganese rose from $471,000 in 1953 to $1 million in 1954. A few large mines furnished the bulk of the production, and 4 mines in Luna and Sierra Counties provided 72 percent of the total shipments. That the continued existence of a local market bolstered the industry is reflected in the fact that in 1954, 94 mining claims produced 55,372 tons of manganiferous material containing 12,738 tons of manganese. This compares with 57

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mines that shipped 13,162 tons in 1953. The counties reporting the most activity in 1954 were Grant, Luna, and Socorro. Open-pit mining continued to be the most used mining method, but a number of underground mines also reported shipments. Generally, lower grade ore was mined in 1954 compared with 1953, but the use of jigs, log washers, and other beneficiation methods at the mine, as well as an increasing number of custom mills operating in 1954, enabled a larger number of marginal operators to sell their mine output. The average price for ore ranging from 15 to 35 percent manganese was $30.85 per ton and for material containing more than 35 percent manganese $85.08 per ton; the average for the State was $32.54.

Molybdenum.—Molybdenum concentrate recovered as a byproduct of copper ore treated at the Chino mill of Kennecott Copper Corp., Hurley, continued to be the major source of this metal in New Mexico in 1954, and shipments of concentrate showed a 66-percent increase over 1953. This gain can be attributed mainly to increased shipments from stocks of concentrate and better recovery of molybdenum, as well as the steady market for molybdenum products.

The Questa Molybdenum mine (known locally as the Moly mine) continued as 1 of only 2 domestic mines operated chiefly for molybdenum in 1954. Shipments of concentrate in 1954 declined, owing to intermittent operations and the lower grade of ore.

Silver.—Silver output in New Mexico in 1954 dropped to half of the 1953 output, which, in turn, was about half of the level held from 1945–52. As in 1953, the decrease was due to declining quantity of zinc and lead-zinc ores mined; these ores yielded 80 percent of the State total silver in 1952, 44 percent in 1953, and 2 percent in 1954. Copper ore yielded 52 percent of the silver in 1953 and 95 percent in 1954. The leading producers of silver in 1954 were the Kennecott Copper Corp. Chino mine in the Central district, Grant County, and the Atwood Mines, Inc., Atwood mine and Banner Mining Co. Miser's Chest mine in the Lordsburg district, Hidalgo County. These 3 mines contributed 94 percent of the State total silver.

Tungsten.—Two operators produced a total of less than 1 short ton of 60-percent WO_3 concentrate in New Mexico in 1954. A small lot of tungsten concentrate (probably selected ore) was shipped from the Zelma No. 14 mine in Grant County by Jim Talbot. Standard Tungsten Corp. produced tungsten concentrate (probably selected ore) from the Baker-Standard mine in the San Simon district of Hidalgo County. This output in 1954 was the first since 1952, which in turn had been the first since 1944. It brought the total production for New Mexico for 1900–54 to 103 short tons of 60-percent WO_3 concentrate.

Uranium.—McKinley, Valencia, and San Juan Counties, in order of value, were the most important uranium-producing counties in New Mexico during 1954. Minor shipments also were reported from Rio Arriba and Grant Counties.

In November Kerr-McGee Oil Industries, Inc., completed construction and began operating a uranium-vanadium processing mill at Shiprock, San Juan County, to concentrate sandstone ores primarily from the Lukechukai and Carrizo Mountains. Process development for the acid-leach and ion-exchange circuit was conducted under coopera-

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tive arrangements with the Bureau of Mines at the Intermountain Experiment Station at Salt Lake City.

In May the Anaconda Copper Mining Co. began construction of an acid-leach sandstone mill at Bluewater, Valencia County, to process ore from the Jackpile mine near Laguna. Anaconda's limestone mill, in operation since 1953, treating Todilto limestone ores from Haystack Butte and other mines, was under construction to increase its capacity. Anaconda reported that cumulative capital expenditure through the end of 1954 for property development and plant and townsite construction in New Mexico was $10.9 million.

Prospecting and exploration activities were widespread in the northern and central portions of the State. The Federal Geological Survey published the results of some reconnaissance work in the State in the fall of 1953.[3]

An annotated list of known uranium occurrences in the State was issued by the New Mexico Bureau of Mines and Mineral Resources.[4]

Three uranium-exploration projects were authorized for DMEA loans.

Vanadium.—Vanadium contained in uranium ores from San Juan, McKinley, and Valencia Counties was recovered as pentoxide at treatment plants in Colorado. The new Kerr-McGee Oil Industries, Inc., uranium mill at Shiprock was expected to recover vanadium.

Zinc.—Zinc output in New Mexico dropped from 51,000 short tons in 1952 to 13,400 tons in 1953, and 6 tons in 1954. A number of the leading zinc and lead-zinc mines had closed in 1952 owing to declining prices. By October 1, 1953, all of the leading zinc and lead-zinc mines that had weathered the sharp decline in the zinc price in late 1952 had closed. None was reopened in 1954, and as a result no zinc or lead-zinc ore was mined in New Mexico in 1954 for the first time since the State became an important producer of zinc in 1903. The Government-stockpile purchasing program for lead and zinc, begun in June 1954 for the purpose of strengthening the price structure and bolstering domestic production, had no noticeable effect on the zinc industry of New Mexico in 1954.

The small quantity of the zinc produced in New Mexico in 1954 came from lead ore from three mines—Lucky 3 (operated by Ed Barker) in Swartz district, Grant County, and the Louise-Halstead-Hansonberg-Prairie Spring group and the Royal Flush mines in Hansonberg district, Socorro County.

NONMETALS

Barite.—Lead-barite ore produced by the Mex-Tex Mining Co., Inc., continued to be the only source of barite in the State during 1954. Shipments of ground barite decreased 35 percent from the 1953 total owing mainly to depletion of developed ore; however, considerable time spent in development work should show results in terms of production in 1955. Ground barite from the company mill at San Antonio was shipped to the major petroleum-producing areas for use as an admixture in preparing well-drilling mud.

[3] Griggs, Roy L., A Reconnaissance for Uranium in New Mexico, 1953: Geol. Survey Circ. 354, 1954, 9 pp.
[4] Anderson, B. C., Occurrences of Uranium Ores in New Mexico: New Mexico Bureau of Mines and Mineral Resources Circ. 29, 1954, 27 pp.

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Clays.—In spite of the high level of building activity throughout the West, the output of clay used in manufacturing building brick and other structural-clay products in New Mexico decreased another 3 percent in 1954 following the 15-percent loss reported in 1953. This decline, though attributable to several factors, appears to be basically caused by declining demand for building materials manufactured from clay.

The bulk of the clay produced in 1954 was common clay or shale, smaller quantities of fire clay being mined. Mining activity was concentrated in Bernalillo, Dona Ana, and McKinley Counties, where the output was common clay or shale. A limited quantity of a special type of clay in McKinley County was utilized in oil-well drilling. An average of 58 men was employed during the year in all mining and plant operations. Brick and structural-clay plants, the only markets open to the clay-mining industry, were in or near the population centers of Albuquerque, Santa Fe, Gallup, and Las Vegas and also El Paso, Tex.

Diatomite.—Crude diatomite was mined early in 1954 by James H. Rhoades Pumice, Inc., from an open-pit deposit near Espanola, Rio Arriba County. The mine output, trucked to the company mill at Santa Fe, was ground, dried, screened, and calcined into a product suitable as an oil and water absorbent. As a result of the inability to market the fines due to the low grade of diatomite, the company was forced to cease operations following only a short period of activity.

Fluorspar.—At year end no fluorspar mines were operating in the State owing to a depressed price for domestic fluorspar ore and concentrate. Large-scale importation of fluorspar was given as the reason for the price decline, and at the end of 1954 no improvement in the market was in sight.

TABLE 13.—Shipments of fluorspar, 1945–49 (average), 1950–54, and total 1909–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	19,474	$615,760	1953	11,890	(1)
1950	20,036	742,408	1954	8,876	(1)
1951	24,402	1,163,098			
1952	16,443	823,320	1909–54	382,684	(1)

[1] Bureau of Mines not at liberty to publish.

The small quantity of fluorspar produced during 1954 came from the Greenleaf mine (Luna County) operated by White & Mathis and the White Eagle (Luna) and Shrine (Grant) mines of the General Chemical Division, Allied Chemical & Dye Corp. Several small operations in Grant and Sierra Counties produced the remainder of the output.

The General Chemical mill at Deming was active throughout the year but on a much smaller scale than in previous years. By the close of 1954 the plant was operating on stockpiled ore and tailings.

Gypsum.—For the first year since 1949, commercial sales of agricultural gypsum were reported. The White Eagle Gypsum Co., Inc.,

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operated an open pit near Las Lunas, Valencia County, and sold its mine-run material to local farmers.

Mica.—For the first time since 1950, sales of sheet mica were reported in New Mexico. Production of this strategic material became possible as a result of broadening of the Government mica-purchasing program in July 1953 to include nonruby mica. After culmination of the World War II buying program, there was no ready market for sheet mica in the Rocky Mountain region. Therefore, when the nonruby-mica program was established, a number of mines began producing. The largest operator was Continental Mine Products Co., producing hand-cobbed mica from the Globe mine, Rio Arriba County. Carl Roseberry also shipped a small quantity of full-trimmed mica from the Globe mine. The second-ranking producing mine was the U. S. Hill in Taos County, worked by the American Mining & Exploration Co., which shipped hand-cobbed material.

Perlite.—The full year's operation of U. S. Gypsum at Grants and the increased output in Taos County by F. E. Schundler & Co., Inc., boosted the State mine production of perlite from 84,900 tons in 1953 to 111,000 tons in 1954, a 31-percent gain.

In its seventh year of production in the State, perlite had risen to the rank of fourth in the nonmetals field, based on value of output. The strong demand for expanded perlite, particularly for oil-well drilling and cementing, kept 47 men employed in mining and milling for 272 days; the product was valued at $886,000. An expanded-perlite plant was operated by Great Lakes Carbon Corp. at Socorro.

Potash.—New Mexico continued as the Nation's leading producer of potash, and production and sales in 1954 reached 1.8 million and 1.7 million tons (K_2O equivalent), respectively. The value of potash sales was $64.4 million—the highest of any mineral produced in the State with the exception of petroleum. Crude-ore production was nearly 10 million tons. The State furnished 90 percent of the total potash produced in the United States. The five producing companies operating mines and refineries in the Carlsbad region, Eddy County, were the Duval Sulphur & Potash Co., International Minerals & Chemical Corp., Potash Co. of America, Southwest Potash Corp., and United States Potash Co., Inc.

TABLE 14.—Production and sales of potassium salts, 1945–49 (average) and 1950–54, in short tons

Year	Crude salts,[1] mine production		Marketable potash salts				
			Production		Sales		
	Gross weight	K_2O equivalent	Gross weight	K_2O equivalent	Gross weight	K_2O equivalent	Value[2]
1945–49 (average)	4,575,328	958,040	1,596,742	855,916	1,609,485	860,739	$32,119,621
1950	5,802,004	1,198,021	1,904,565	1,086,996	1,878,094	1,072,772	37,108,251
1951	6,615,891	1,349,572	2,138,439	1,223,139	2,126,391	1,217,617	43,427,717
1952	7,852,732	1,644,034	2,530,596	1,468,029	2,439,042	1,411,125	52,483,464
1953	9,100,671	1,908,280	2,937,960	1,721,435	2,661,587	1,552,831	58,076,435
1954	9,975,460	1,985,626	3,007,724	1,763,378	2,954,043	1,732,240	64,366,641

[1] Sylvite and langbeinite.
[2] Revised values, except for 1954.

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In 1954, 4,000 persons were directly employed by 5 potash companies and received $1.5 million a month in wages, most of which was retained in Eddy County and the State. The impact of this segment of the mineral industry can be further emphasized when it is realized that, in addition to its material purchases and taxes, freight charges paid on freight originated by the industry have been estimated at over $35 million per year.

The demand for 60-percent muriate of potash furnished the bulk of 1954 sales, but other grades sold included 50-percent muriate of potash and 22-percent manure salts. In addition, a hydrocloric-acid plant operated by International Minerals & Chemical Corp. began operations in 1954, most of the output going to the oil industry.

Developments in the area in 1954 included an announcement by The Freeport Sulphur Co. and Pittsburg Consolidation Coal Co. that a new company, National Potash Co., will be formed to develop potash deposits near Artesia. The National Farmers Union and Kerr-McGee Oil Industries planned to develop their potash deposits in the same region. A pilot plant was to be set up at the Colorado School of Mines to study treatment methods for the material and a new company formed by the two firms to produce potash.

Pumice and Pumicite.—Owing to decreased demand for pumicite and scoria by the construction industry, the output of pumice in New Mexico in 1954 decreased to 364,000 tons, a 31-percent drop from 1953. Producers of this material faced increased competition from perlite and bloated shale for the concrete-aggregate market. Higher freight rates, coupled with a general increase in the cost of production, were gradually pricing the New Mexico producer out of the market. In 1954 pumice (pumicite and scoria) used for concrete aggregate dropped to 231,900 tons compared with 280,600 tons in 1953. The only other important use is for railroad ballast, which fell from 231,000 tons in 1953 to 121,700 tons in 1954.

The origin of most of the mine output was the same as in 1953—Union, Dona Ana, and Rio Arriba Counties.

Some high-grade ground pumice for use in cleaning and scouring compounds, abrasives, and acoustic plaster was sold by General Pumice Corp., Rio Arriba County, and James H. Rhoades Pumice, Inc., Sandoval County. Output of this product also was considerably below the 1953 level, thus further emphasizing the depressed condition of the industry.

Salt.—The State salt industry is based on the limited local market for salt and the high concentration of salt in accumulated potash-mill tailing. Most of the salt consumed in the State was in the form of rock salt for cattle and other domestic animals; the remainder was used for manufacturing water softeners and in oil-well drilling. Although cattle raising in the Southwest forms the market base for the industry, drought conditions have affected cattle population; as a result, emphasis is being placed on developing a firmer market in the oilfields of southeastern New Mexico and northwestern Texas.

Solar evaporated salt was produced by the Curtis Salt Co. at its facility near Quemado, Catron County.

Although the quantity of salt sold in 1954 dropped 18 percent compared with 1953, the total value of these sales showed a 54-

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percent increase. This nonconformity to normal movements of quantity and price is only significant in that it reflects the erratic nature of an infant industry.

Sand and Gravel.—Sand and gravel production has been credited to 20 of New Mexico's 31 counties. More than half (4,258,000 tons valued at $5,148,000) of the total quantity produced could not be assigned to counties of origin. Data reported in 1954 are not directly comparable with those for 1953, owing mainly to expanded coverage of the statistical canvass. New Mexico's economic improvement resulted from a general upward trend in the construction industry, although the effect cannot be accurately measured. The activity of the State highway department was a dominant factor in this branch of the mineral industries, as most of the sand and gravel output resulted from its contracts. Of the total State output in 1954, 5,172,011 tons or 79 percent was produced by contractors working on highway contracts. The employment and resulting income generated by this type of activity are reflected in production and employment data in the annual report by the State Mine Inspector. According to data in this report, labor productivity for the sand and gravel industry, was 8,460 tons per man-year, indicating that about 7,700 men were employed in the industry. This considers only production workers.

Stone.—Accelerated highway construction in New Mexico was shown in a 23-percent increase in the production of all types of stone during 1954. Miscellaneous stone comprised the bulk of the output, followed by crushed basalt and limestone; a small quantity of crushed sandstone and marble and some dimension sandstone were sold for building purposes. Most of the State output of stone was from Valencia, Colfax, and Grant Counties.

Sulfur.—The production of elemental sulfur recovered as a by-product of natural gas remained a minor contributor to the State mineral output. Sales in 1954 increased 26 percent over 1953. Three plants, operated by the El Paso Natural Gas Co. and Warren Petroleum Corp., Lea County, and Imperial Sulphur & Acid Co., San Juan County, produced the entire State output. The Eunice plant (Lea County) of El Paso Natural Gas Co. began operation in February. The Farmington plant (San Juan County) of Imperial Sulphur & Acid Co. was sold to El Paso Natural Gas Co. in August and was nonoperative for the remainder of the year.

Vermiculite.—The plant of Southwest Vermiculite Co. at Albuquerque produced exfoliated vermiculite for use in concrete and plaster aggregate and insulation from crude material received from out of the State.

MINERAL FUELS

Carbon Dioxide.—The production and value of carbon dioxide increased 5 and 12 percent, respectively. Gruemmer Indiana Carboric, Inc., completed construction and during March began operating a plant to produce liquid carbon dioxide from wells in Union County.

Coal.—Coal production, trending downward over the last 10 years, fell precipitously during 1954 to 123,000 tons from 513,800 tons in 1953.

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Three factors influencing the declining market demand for New Mexico coal were: Increasing substitution of natural gas and fuel oil in space heating, dieselization of the railroads, and loss of the major market for coking coal. The first two factors have operated both on a local and on a national scale, but the last factor applies more specifically to New Mexico.

During 1953 the Colorado Fuel & Iron Corp. developed new productive capacity of coking coal in the Trinidad field of southern Colorado and was able to supply the demands of its steel mills in Pueblo, Colo., from this closer source. In prior years the Pueblo mills consumed much of the New Mexico output of coking coal.

TABLE 15.—Production of coal, 1953–54, by counties, in short tons

County	1953	1954	County	1953	1954
Bernalillo	1,030	----------	Sandoval, San Juan, Santa Fe, Socorro	25,297	11,642
Colfax	423,465	67,234	Valencia	7,725	----------
McKinley	40,650	34,033	Total	513,781	123,099
Rio Arriba	15,614	10,190			

Although the decline in production affected all producing counties, Colfax County (the leading producer in the State) felt the results most strongly. During the fall of 1953 and the spring of 1954, many mines were cut back, placed on standby, or closed. The St. Louis, Rocky Mountain & Pacific Fuel Co., New Mexico's major coal producer, closed its Brilliant No. 2 and Van Houten mines and reduced production sharply from the Koehler mine. The New Mexico Miner reported that 200 miners and their families in the Raton area were receiving aid from the State Welfare Department in March 1954.

Although some of the miners may have moved north to the Trinidad field in southern Colorado, many were dispersed to other areas and industries.

Helium.—Helium shipments from the Navajo Helium Plant south of Shiprock, San Juan County, increased almost fourfold during 1954. The plant and the Nation's other three helium plants at Exell and Amarillo, Tex., and Otis, Kans., are owned by the United States Government and operated by the Bureau of Mines.

Greater demand by the Armed Forces, the AEC, other Government agencies, and industry led to a 12-percent increase in total annual shipments for the United States in 1954 compared with 1953. About 95 percent of the national increase fell to the Shiprock plant.

Comprehensive information on helium is given in the commodity chapter [5] of the Minerals Yearbook.

Petroleum and Natural Gas.—Production of petroleum and natural gas continued to grow during the year, showing gains of 6 and 12 percent, respectively, over 1953. Production was from Lea, Eddy, and Chaves Counties, which were predominantly oil producers, and San Juan County, McKinley, Rio Arriba, and Sandoval Counties, primarily gas producers.

[5] Kennedy, H. S., and Wheeler, Henry P., Jr., Helium: Minerals Yearbook, 1954, vol. II, 6 pp.

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TABLE 16.—Production of crude petroleum, 1953–54, by districts and fields, in thousand barrels

[Oil and Gas Journal]

District and field	1953	1954	District and field	1953	1954
Southeast:			Southeast—Continued		
Bagley	2,033	1,867	Hobbs	3,663	3,340
Brunson	3,007	2,264	Langlie-Mattix	1,669	1,402
Caprock—East	1,886	2,135	Lovington and East	2,472	3,250
Crossroad	939	1,355	Maljamar	1,792	1,790
Denton	8,668	10,651	Moore	921	1,166
Dollarhide—West	1,978	3,251	Saunders and South	2,164	2,200
Drinkard	3,454	2,828	Vacuum	4,281	3,832
Eunice-Monument	9,321	9,029	Warren	1,438	1,469
Fowler	(1)	837	Other fields	[2] 15,466	[2] 17,112
Gladiola	1,304	1,571	Northwest [2]	776	715
Grayburg-Jackson	1,162	1,114			
Hare	2,047	1,642	Total	[2] 70,441	[2] 74,820

[1] Included with "Other fields."
[2] Bureau of Mines data.

In 1954 the Federal Power Commission approved Pacific Northwest Pipe Line Corp. plans for constructing facilities to carry natural gas from the San Juan basin, western Colorado and eastern Utah, to the Pacific Northwest. These facilities will permit release of some of the "shut-in" natural-gas capacity now available in the San Juan basin.

REVIEW BY COUNTIES

Bernalillo.—Structural sand and gravel furnished all but $30,000 of the county mineral-production value. The three largest commercial producers (Albuquerque Gravel Products Co., Davis Sand & Gravel Products Co., and Springer Transfer Co.) employed an average of 68 men, who worked 19,800 man-days in all. Contracts let by the Federal Bureau of Reclamation and the United States District Engineer resulted in producing 391,000 tons of paving sand and gravel. Total commercial and Government-and-contractor sales in 1954 more than doubled the comparable figures for 1953, resulting largely from the activity of Federal Government contractors.

The demand for building brick and other structural-clay products in the county was satisfied mainly by the Kinney Brick Co. plant, Albuquerque, using clay mined nearby. Mine output totaled 15,000 tons of common clay.

Several concrete-block plants in the county utilized scoria, pumice, and pumicite mined nearby. A small quantity of crushed basalt was quarried for riprap in road construction.

Exfoliated vermiculite for use in concrete and plaster aggregate and insulation was produced at the Southwest Vermiculite Co. Albuquerque plant from out-of-State raw material.

Catron.—Although a small quantity of silver was produced in Catron County during 1954, sand and gravel, and salt contributed the greater share of the county mineral-output value.

Stimulated by the letting of contracts by the Federal Bureau of Public Roads, local contractors produced paving sand and gravel valued at $33,165 in 1954; this compares with $11,070 in 1953.

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TABLE 17.—Value of mineral production in New Mexico, 1953–54, by counties [1 2 3]

County	1953	1954	Minerals produced in 1954 in order of value
Bernalillo	[4] $615,380	$1,361,136	Sand and gravel, pumice and pumicite, clays, stone.
Catron	23,319	(5)	Sand and gravel, salt, silver.
Chaves	47,973	135,570	Sand and gravel, clays.
Colfax	[4] 2,648,770	510,881	Coal, stone, sand and gravel.
Curry	----------	400,000	Sand and gravel.
De Baca	8,375	----------	
Dona Ana	213,401	323,651	Sand and gravel, pumice and pumicite, stone, clays.
Eddy	[4] 58,284,047	64,696,699	Potash, salt, sand and gravel.
Grant	[4] 44,230,355	35,487,883	Copper, molybdenum, gold, manganese, stone, silver, iron ore, sand and gravel, lead, perlite, tungsten, zinc, fluorspar.
Guadalupe	308,238	76,700	Copper.
Hidalgo	1,308,536	1,414,841	Copper, silver, sand and gravel, gold, clays, lead, tungsten.
Lea	(5)	(5)	Sulfur.
Lincoln	9,125	863	Lead, silver.
Luna	(5)	(5)	Fluorspar, sand and gravel, silver.
McKinley	[4] 263,108	206,878	Coal, clays.
Otero	110,988	607,174	Sand and gravel, copper, gold, silver, clays.
Quay	43,042	24,000	Sand and gravel.
Rio Arriba	[4] 354,556	602,752	Pumice and pumicite, coal diatomite, mica, sand and gravel, columbium-tantalum, beryl.
Roosevelt	----------	1,500	Sand and gravel.
Sandoval	[4] 100,110	71,173	Pumice and pumicite, sand and gravel, coal.
San Juan	[4] 152,724	243,577	Sand and gravel, stone, sulfur, coal.
San Miguel	8,027	26,367	Sand and gravel, stone, beryl, clays, columbium-tantalum.
Santa Fe	[4] 189,431	370,697	Pumice and pumicite, sand and gravel, coal, copper, gold, clays, silver.
Sierra	12,504	789	Silver, gold, fluorspar.
Socorro	[4] 793,800	596,799	Perlite, lead, barite, stone, coal, copper, sand and gravel, silver, zinc, gold.
Taos	(5)	556,038	Perlite, molybdenum, beryl, mica, silver.
Torrance	----------	53,211	Sand and gravel, silver.
Union	(5)	136,454	Pumice and pumicite.
Valencia	[4] 389,105	378,031	Perlite, stone, sand and gravel, gypsum.
Undistributed	[4] 226,465,116	265,315,128	
Total	[4] 336,580,000	373,599,000	

[1] The following counties are not listed because no production was reported: Harding and Mora.
[2] Value data of petroleum, natural gas, natural-gas liquids, vanadium, manganese, beryl (1954), carbon dioxide (natural), gem stones, helium, and some undistributed sand and gravel and stone are excluded from county totals and included with "Undistributed" to avoid disclosure of individual company operations.
[3] Value of low-grade manganese ore shipped to General Services Administration Purchase Depots and uranium ore are excluded.
[4] Revised figure.
[5] Value included with "Undistributed."

The solar-evaporation facility of the Curtis Salt Co., Quemado, operated throughout the year. Shipments of salt to feed dealers for livestock use and as a water softener were reportedly made to Arizona and local consumers.

The Cherry Mining Co. made a test shipment of silver ore from the Mitchell Mines (Virginia B.) to the El Paso smelter produced in conjunction with a development and exploration program. C. T. McLendon recovered a small quantity of silver from a cleanup at the Graham mill.

Chaves.—Sand and gravel and clay were the only two minerals produced in the county during 1954. Sand and gravel sales for residential and some industrial construction were reported by five commercial producers. Hagerman Sand & Gravel Co. and F. A. Stacy & Son were the leading producers.

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Clay for use in drilling oil wells was mined by the Native Blanco Clay Co., Lovington. Two men were employed 200 days.

Colfax.—Mineral activity in the county during 1954 was reported by the coal, stone, and sand and gravel producers.

Coal production dropped to one-sixth of the 1953 rate. The Brilliant No. 2 and Van Houten mines of the St. Louis, Rocky Mountain & Pacific Fuel Co. were closed. The Van Houten mine was closed completely in February. A small crew was active at the Koehler mine; and during the fall, buildings in the town of Koehler were dismantled and 62 houses moved to other areas.

Production and sales of basalt riprap were reported by three contractors engaged in road construction for Government agencies. Contractors, working in conjunction with the Federal Bureau of Public Roads, produced 31,985 tons of paving sand and gravel.

TABLE 18.—Number of men employed in coal mining in Colfax County compared with New Mexico, fiscal 1953–55 [1]

Fiscal year:	*New Mexico*	*Colfax County*
1952–53	719	541
1953–54	360	193
1954–55	174	67

[1] Source: 41st, 42d, and 43d Annual Reports of the New Mexico Inspector of Mines.

Dona Ana.—In order of importance, sand and gravel, pumice, manganese, clay, and stone comprised Dona Ana County mineral-production value.

The State highway department, Federal Bureau of Reclamation, and United States District Engineer provided a paving sand and gravel market for local contractors.

During the year Central Mining Co. shipped manganese ore from the Rincon Lode, and lessees working the Blackie claims shipped 42 long dry tons of ore containing 37 percent manganese to the Deming, N. Mex., Government Purchase Depot. This ore was stockpiled for future treatment. Production is not credited for 1954 but will be reported in the year during which the beneficiated product is shipped.

The steady demand for brick and structural-clay products in the El Paso, Tex. area continued to provide a ready market for raw clay mined at the El Paso Brick Co. Brickland pit and International Brick Co. Bowen quarry. An average of 4 men was employed at the Bowen quarry for 13 days, whereas at the Brickland-pit quarry 10 men worked 240 days.

Contractors quarried crushed basalt in the form of riprap for use in county road construction.

Eddy.—In 1954 Eddy County again ranked first in the State in terms of value of mineral output. Potash valued at $64 million contributed almost the entire mineral value, followed by salt and sand and gravel.

Demand for refined potash in 1954 surpassed the record established in 1953. Five producing companies employed 4,000 men, sustaining the county economy and accelerating mining activity to keep pace with refinery operations. United States Potash Co. completed No. 3 shaft during the year at a cost of $1 million and announced plans for a new storage warehouse at Loving, Eddy County, costing $650,000 and

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holding 70,000 tons of finished product. All producing companies constructed additional warehouse facilities in 1954 at an overall cost of several million dollars.

Kerr-McGee Oil Industries, a major independent oil-gas producer, entered the potash-mining industry after negotiations with National Farmers Union were concluded. This joint venture planned to develop 17,000 acres of potash lands near Artesia. The Potash Co. of America announced that it was installing a 7¼-mile conveyor-belt system in its mine to haul ore from the working faces to the shaft. In 1954 ore was mined largely by continuous mining machines and then hauled by belt conveyors to trains. It was planned to have ore haulage done by belts. The Freeport Sulphur Co. and Pittsburg Consolidation Coal Co. began developing its low-grade potash deposit in T. 20 S., Rs. 31 and 32 E., Eddy County. The ore occurs in a bed 25 feet thick and will be mined by conventional potash-mining methods.

Rock salt produced by the Salt Supply Co., Carlsbad Salt Products, Inc., Southwest Salt Co., and United States Potash Co., Inc., all of Carlsbad, constituted the bulk of the salt sales in 1954. Although the tonnage sold decreased 18 percent in 1954 compared with 1953, the value of sales increased 54 percent. The tonnage drop was due to the general drought conditions in the Southwest, which reduced the number of cattle, the leading consumers of salt. On the other hand, the average value showed a substantial gain as a result of the production of a cleaner, more specialized product. The use of salt, relatively new in oil-well drilling, opened a new market potential for producers that should broaden the market base and provide the industry with an additional outlet.

Sales of structural sand and gravel were reported by the Hunt Sand & Gravel Co., Lovington.

Grant.—Over 95 percent of the combined value of gold, silver, copper, lead, and zinc production of New Mexico came from Grant County in 1954. The combined value of the 5 metals for this county was 21 percent less than 1953, owing principally to decreases of $6 million in the value of the copper output and $3 million in the value of the zinc output. Lower production of copper was due to reduced domestic demand in the first quarter and work stoppages later in the year. The drop in zinc output was caused by the low price for the metal, which forced the zinc mines in Grant County to close.

Molybdenum concentrate was recovered as a byproduct from copper ore treated at the Chino mill at Hurley.

Small tonnages of manganese ore were shipped to the Deming, N. Mex. Government Purchasing Depot from 19 scattered mines and prospects in Grant County. Sixteen mines produced 1,262 long dry tons of ore containing 5 to 35 percent manganese, and 3 mines produced 1,025 tons containing 35 percent or more manganese. The 5 largest producers (all with an output of more than 100 tons) were Bear Mountain, Black Eagle, Joe Nos. 1 and 2, and Consolidation mines. The Luck Mining & Construction Co. shipped 20,546 short tons of ferruginous manganese ore containing an average of 10.8 percent manganese from the Boston Hill open pit near Silver City to the Colorado Fuel & Iron Corp., Pueblo, Colo., for use in its blast furnaces for making steel.

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The Pearson iron pit near Fierro in the Central district was operated intermittently by Mathis & Mathis in 1954 to fill two orders for magnetic iron ore, once during July and August and again in November and December. Part of the ore was used in manufacturing cement. Mathis & Mathis were subleasers of the Pearson iron pit from the United States Smelting, Refining & Mining Co.

Jim Talbot shipped a small lot of tungsten concentrate (probably selected ore) from the Zelma No. 14 mine to the National Hardware & Supply Co., Bishop, Calif., which, in turn, sold it to the General Services Administration.

Because of the low price for fluorspar, the Shrine mine of the General Chemical Division, Allied Chemical & Dye Corp., operated for only a short period during 1954.

Stone was the principal nonmetal produced, in terms of total value. Kennecott Copper Corp. quarried limestone for smelter flux, and the Marblite Products Co. sold a small quantity of crushed marble. The output of sand and gravel was contracted for and used by the county and State highway departments. The El Paso Perlite Co., Inc., mined perlite, which was expanded at its plant near Deming.

Central District.—Most of the State output of copper came from the large Chino open-pit mine of the Kennecott Copper Corp., Chino Mines Division, Santa Rita. Because of the lower demand for copper and the accumulation of stocks of refined copper, operations were reduced to a 5-day, 40-hour workweek in March, but returned to a 7-day workweek late in September. A labor strike from August 16 through September 1 further curtailed production for the year.

According to the Kennecott Copper Corp. annual report for 1954, 58,197 short tons of copper was recovered from 6,536,058 short tons of ore mined and milled. The ore from the pit was transported 10 miles by railroad to treatment plants at Hurley. The Hurley mill had a daily capacity of 22,500 tons of ore. The copper concentrate recovered from the ore was smelted in the company smelter adjacent to the mill. Copper precipitate recovered by leaching of dumps was also smelted. Siliceous copper ore from the pit was used as a flux for the smelter charge of concentrate and precipitate. Molybdenum was recovered in the concentration mill as a byproduct and selenium-bearing slag as a smelter byproduct. The copper bullion contained minor quantities of gold and silver, which were not recovered from the bullion that was fire-refined at Hurley. Some recoverable gold and silver were contained in the blister copper shipped for refining.

The work of relocating mine shops and offices and other buildings and equipment in Santa Rita (accomplished in about 3 years by the Kennecott Copper Corp. without interrupting normal operations) was virtually completed in 1954. This involved moving houses, stores, mine offices, and shops 4 miles and installing new sewer, water, and power lines. The company stated that a minimum of 33 million tons of ore was freed for mining by the move. Stripping of the overburden from the ore was started in the cleared areas. Two 125-ton electric locomotives and twenty 40-cubic-yard-capacity haulage cars were placed in service during the year to provide the necessary additional stripping facilities—1.94 tons of waste was removed for every ton of ore mined, compared with 1.67 tons in 1953.

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Because of the depressed prices of zinc and lead, the Bayard group of mines was placed on a shutdown basis by the United States Smelting, Refining & Mining Co. on October 1, 1953, and remained so throughout 1954. However, on block leases from the company, several individuals produced moderate quantities of copper, with minor quantities of lead and silver as byproducts; Felix T. Jaramillo and Juan Gonzales mined and shipped copper ore from the Ansons (Continental) mine; Douglas B. White mined copper ore with a bulldozer from the Zuniga mine (opencut) and heap-leached it to produce copper precipitate, which was shipped to the El Paso smelter; and the J. H. Thompson & J. B. Bolton partnership and Arcadio M. Tellez shipped copper-lead ore from the Bayard mine. The Holquin, Lopez & Molinar partnership shipped a small quantity of gold ore to the El Paso smelter from the Boston Bicket mine, which was also on lease from the United States Smelting, Refining & Mining Co. The Deering, Patton & Chaney partnership made one shipment of copper precipitate, which was recovered from leaching at the Paola mine. A small quantity of copper was recovered from crude ore shipped to the El Paso smelter from the Super Cobre mine by New Mexico Mineral Exploration Co.

The Ground Hog mine of American Smelting & Refining Co., Oswaldo mine of Kennecott Copper Corp., Kearney mine of New Mexico Consolidated Mining Co. (subsidiary of the Peru Mining Co.), Pewabic mine of Peru Mining Co., and Hanover mine of New Jersey Zinc Co. (Empire Zinc Division), which have been large and important producers of zinc in past years, remained closed throughout 1954.

Pinos Altos District.—Small lots of ore were shipped from three mines in the district; C. L. Wright shipped gold-silver ore from the Continental mine, C. Phillips and T. Montoya made a test shipment of copper ore from the Deero Copper mine, and Thomas Blocker shipped one lot of ore that was recovered during assessment work from the George Schafer-Rotation mine. In addition, a substantial quantity of mill tailing from the Mammoth dump was shipped to the El Paso smelter by J. & J. Exploration Co. for use as a siliceous flux. Moderate quantities of gold, silver, copper, and lead were recovered from the tailing.

Three of the four active placer mines in the State in 1954 were in the Pinos Altos district. They were operated by Frank W. Fletcher, Floyd Hamilton, and Miss Emily Himes.

Other Districts.—The Atrimas Uranium Production Co. reportedly began shipments of uranium ore in October from the White Signal district south of Silver City. Two railroad carloads of gold ore were shipped to the El Paso smelter by Yacoma, Inc., from the Carlisle group in the Steeple Rock district. A few tons of lead ore was shipped from the Lucky 3 mine in the Swartz mining district. The mine was worked on a part-time basis by Ed Barker, the owner, and his partners. The Phelps Dodge Corp. conducted exploration work at its copper property in the Burro Mountain district.

Guadalupe.—Drunzer & Casner shipped 7,673 tons of siliceous fluxing ore containing 130 tons of recoverable copper to the El Paso smelter in 1954 from the Stauber open-pit mine near Santa Rosa.

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Hidalgo.—Mining activity in 1954 was concentrated in the long-established metal-mining districts. As in 1953, the base metals, mainly copper, comprised most of the value of mineral output of Hidalgo County, followed by silver, gold, lead, and tungsten. Sand and gravel was the most important nonmetal in terms of value, and a small quantity of clay was mined.

The copper output of the county in 1954, mostly from the Lordsburg district, increased slightly over 1953. As in each year since 1936, the Banner Mining Co. Miser's Chest group, 5 miles south of Lordsburg, was the principal producer. The ore was treated in the company 400-ton mill at the mine to produce a copper-flotation concentrate from which gold and silver also were recovered. Concentrate was shipped to the El Paso smelter. The Atwood copper mine was operated by the Atwood Mine, Inc., under lease from J. L. Augustine and Rebecca Morningstar, as an underground mine from January through March and as an open-pit mine for the remainder of the year. In addition to copper, substantial quantities of gold, silver, and lead were recovered from the ore shipped to the El Paso smelter. A small lot of silver ore was shipped from the Susie mine by the Potter, Drona & Bowman partnership. The ore was mined during an exploration and development program conducted during the first part of the year.

The Tuco Mining Co. purchased the Copper Dick mine in the Sylvanite district from the Dick Tyler estate in February 1954. Copper ore from the open-pit mine was shipped directly to the El Paso smelter.

As a result of the shutdown of all zinc and lead-zinc mines in the State and the lack of any zinc recovery from copper ores, no shipment of zinc was reported in 1954.

The Standard Tungsten Corp. shipped tungsten concentrate to Sun Valley Tungsten Co., Sun Valley, Calif., which was recovered from ore mined from the Baker-Standard mine in the Peloncillo Mountains, San Simon district.

Small lots of manganese ore were shipped to the Deming, N. Mex. Government Purchase Depot from Hidalgo County in 1954 from the Kuykendall, Lucky 3, Plains, Rusty Ruth Lee, Pendleton, and Ridge No. 1 mines.

In conjunction with normal maintenance and construction activities on State highways, New Mexico Highway Department crews quarried and prepared 11,450 tons of paving sand and gravel during 1954.

Mine production of fire clay was sustained in 1954 by the demand for refractory products by Phelps Dodge Corp. smelter facilities at Douglas, Ariz. The company employed 1 man for 262 days at the Pratt fire-clay quarry and produced fire-clay furnace stoppers for its furnaces and in addition sold a small quantity.

The Amber Pearl perlite mine near Lordsburg of Kirk's Perlite Industries was idle throughout the year.

Lea.—The dedication in February of the Eunice plant of the El Paso Natural Gas Co. brought to two the number of plants in Lea County recovering elemental sulfur from sour natural gas. The finished product is high-purity sulfur used in the chemical and manu-

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facturing industries. The combined plant capacity was 130 tons daily.

Lincoln.—The Little Wonder mine was worked by W. A. Mays for the first 4 months of the year. The lead ore, from which silver was also recovered, was shipped to the El Paso smelter.

Luna.—Historically, fluorspar mining and milling has been an important activity in the county. Over the years countless small-mine operators have marketed their ore at the fluorspar flotation mill of General Chemical Division, Allied Chemical & Dye Corp., at Deming. However, in 1954 the depressed price for crude ore brought about the closing of all fluorspar mines in the county. During the first half of 1954 the Greenleaf mine operated by White & Mathis and the White Eagle mine of General Chemical shipped crude fluorspar to the custom mill at Deming. However, the availability of low-cost foreign ore caused these mines to shut down, and at year end the Deming mill was operating on a limited basis on stockpiled ore and tailings.

Contracts let for construction and maintenance of State highways by the New Mexico Highway Department created a demand for a limited quantity of paving sand and gravel. In addition to this production, a small quantity of structural sand and gravel was sold by a commercial producer.

A small quantity of silver was recovered from ore shipped from the Lindy Ann group in the Cooks Peak district by C. D. Milliken. The American Smelting & Refining Co. zinc-lead-copper selective flotation mill at Deming remained closed throughout 1954, as did the 1,250-ton Peru Mining Co. zinc-lead mill near Deming.

The impact on the county mining industry resulting from the shutdown of all fluorspar mines was lessened as a result of the local outlet for manganiferous material at the Deming, N. Mex. Government Purchase Depot. As a result of this, market shipments from 13 individual mining claims were reported. Manganese ore containing over 35 percent manganese was shipped from 2 other claims. The largest individual shipper was Florida Mining, Inc. (formerly Southwest Mining Co.), operating the Manganese Valley mine, as well as a custom mill adjacent to the depot. Other mines reporting shipments included the American No. 29, Birchfield, Black Vein, Doubtful No. 2, Eczema, Esperanza, Iron Clad, Luna, Manganese Chief No. 6, Rio Salado No. 1, Southside, and Torres. Shipments totaled 8,100 tons.

McKinley.—Coal and clay supplied the total recorded mineral production in McKinley County in 1954. The county was the second-ranking coal producer in the State and the leading uranium-ore producer.

The Gallup Brick & Tile Co. operated strip and underground clay mines throughout 1954 and employed 5 men for an average of 100 days, supplying raw clay to the company brick and raw-clay customers. Most of the 1954 clay output was sold for oil-well-drilling mud, and the remainder was used in manufacturing refractory brick and block and mortar.

Otero.—The backbone of the county mineral industry in 1954 continued to be the sand and gravel operators, who furnished 99 percent of the total value of all minerals produced in Otero County.

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However, a copper mine, a gold concentrator, and a clay quarry provided limited employment for a number of miners.

Test shipments of copper ore were made from the Bonanza mine in the Orogrande district by J. Burnett and from the Copper Beauty No. 1 in the Tularosa district by the Keesee & Snedeger partnership. Small quantities of gold and silver were recovered from the copper ore.

In the process of testing a newly developed gravity dry concentrator for use in placer mining, the Colorado Dry Concentrator Co. recovered a small quantity of gold from gravel mined near Orogrande.

Roadwork provided the stimulus that resulted in the production of 371,300 tons of paving sand and gravel. Contracts let by the Federal Bureau of Public Roads and the United States District Engineer comprised the bulk of the activity in 1954, and Frank P. Llewellyn, Inc., reported that 20 men worked 24 days producing structural and paving sand and structural, paving, and railroad-ballast gravel.

Harry E. Fleckinger (La Luz Clay Products Co.) mined 25 tons of common clay and manufactured roofing tile for the building industry.

Rio Arriba.—The mineral industry of Rio Arriba County showed considerable improvement in 1954, in terms of value of output, compared with 1953. Despite the decrease in the value of coal, columbite-tantalite, and diatomite, the value of all minerals totaled $603,000 in 1954, compared with $355,000 in 1953. Mining and preparation of pumice (pumicite and scoria) were largely responsible for the gain, and for the first time in a number of years sales of sheet mica were reported.

The demand for pumice products and scoria for concrete aggregate provided a steady market for these products. General Pumice Corp. operated its Cullum pit and shipped pumice to Santa Fe and Albuquerque, and Folsom Cinder worked its scoria pit and shipped crude ore to Pueblo and Denver, Colo., and to other States.

A deposit of low-grade diatomite near Espanola was mined during the spring of 1954 by James H. Rhoades Pumice, Inc. The crude ore was shipped to the company processing plant at Santa Fe, where finished ground diatomite was produced. As a result of the inability to market fines and the poor quality of the deposit, operations were suspended indefinitely.

With a local market for mica at Custer, S. Dak., operators in the mica district in Rio Arriba County were again active by the end of the year. Continental Mine Products Co. and Carl Roseberry shipped hand-cobbed and full-trimmed sheet mica from the Globe mine.

The New Mexico Highway Department engaged in quarrying and preparing paving sand for use in conjunction with roadwork.

During 1954 Jean H. Stivers recovered beryl from the Apache mine, 3 miles north of Petaca, and sold it to the General Services Administration. Small quantities of columbite-tantalite were produced from the Miller group by the Cooperative Mines, Inc., and from the Petaca mine by Petaca Placer.

Small shipments of uranium ore were reported.

Sandoval.—Pumice continued to be the most important mineral, in terms of value, and the entire production was used in concrete aggregate by Dooley Bros. Pumice, Inc., and Lava-Pumice Co., Inc. Small quantities of coal and sand and gravel also were mined.

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A few tons of manganese ore was shipped from the Lander mine by Sterling C. Landers to the Deming, N. Mex. Government Purchase Depot.

San Juan.—The county mineral industry reported production of sand and gravel, stone, sulfur, coal, petroleum, and natural gas.

The production and sale of structural sand and gravel, as well as a small quantity of paving sand and gravel, was the most important activity in terms of value of output. The major producers were Jensen Ready Mix Co., Inc. (Navajo and Dallas pits), and the San Juan Gravel Products Co.

The recovery of elemental sulfur as a byproduct of natural gas ranked second in terms of value of output. The Farmington plant of Imperial Sulphur & Acid Co. was sold to El Paso Natural Gas Co. in August. The plant, rated at 1 ton of sulfur per hour, drew sour natural gas from the Barker Dome field.

Helium was produced at the Government plant at Shiprock.

Construction was begun in January on the Kerr-McGee Oil Industries uranium mill at Shiprock. The mill began operating during November, and at year end 100 men were employed.

San Miguel.—Although sand and gravel contributed most of the county mineral-production value, stone quarries and clay and beryl mines reported some activity.

Construction and highway projects in 1954 resulted in an increased production of paving sand and gravel. In addition, Henry Young Gravel Co. employed 3 men for 240 days quarrying and processing structural gravel. Small localized demand for building brick and other structural-clay products was satisfied by Las Vegas Brick Co. Crushed sandstone for riprap and for use in concrete aggregate, as well as dimension sandstone, were quarried by Joseph C. Hastings and Taylor quarries.

Some beryl and columbite-tantalite were produced from the Old Priest (Pablo Lopez) pegmatite quarry near Ribera by the Onego Corp. in 1954.

Santa Fe.—Mining activity in Santa Fe County produced pumice, the most important mineral in terms of value, and sand and gravel, coal, copper, gold, clay, and silver.

Concrete-block plants and concrete-aggregate producers received crude pumice from Santa Fe Pumice Co., Inc., as well as mines in other counties. Sales of prepared pumice in 1954 showed a threefold increase over 1953 contrary to the downward trend of statewide sales.

Kauffman Trucking Co. quarried structural sand and gravel and furnished 95 percent of the county production. A Federal Bureau of Reclamation contractor produced a small quantity of structural gravel. The New Mexico State Penitentiary manufactured building brick and tile from purchased clay, which was sold to building-supply firms and private individuals.

Small quantities of copper, gold, and silver were recovered from copper ore shipped to the El Paso smelter from the Evelyn mine in Cerrillos district by C & W Mining Co. and from the San Pedro mine in the San Pedro or New Placers district by Verne Byrne.

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The Central Mining Co. made a shipment of manganese ore from the Abe Lincoln mine to the Deming, N. Mex. Government Purchase Depot in 1954.

Sierra.—The number of active mines in Sierra County was reduced from 8 small mines producing gold, silver, lead, and zinc in 1953 to 2 mines producing only silver in 1954. Marie B. Benjamin conducted development and exploration work at the Calamity Jane mine in Kingston district and made a small shipment of silver ore from the dump. Silver was recovered from ore mined from the Dove mine in Kingston district by J. H. Shoemaker. Development and exploration work was conducted by Alvin W. Emerick and T. J. Hazelton at the Palomas Chief and Skylight mines, respectively.

In 1954 low-grade managanese ore was shipped to the Deming, N. Mex. Government Purchase Depot from 22 mines in Sierra County. Most of the ore was shipped from 2 mines, Ellis and Lake Valley, operated by Tower Mining & Refining Co. and Haile Mines, Inc., respectively.

Socorro.—Although the same mineral commodities were produced in Socorro County both years, the value of all minerals dropped from $793,800 in 1953 to $596,800 in 1954—a decrease of 25 percent. The loss was due to decreases in the value of output of metals; all nonmetals except barite showed significant gains.

The most important mineral commodity, in terms of value of output, was perlite, mined and processed by the Great Lakes Carbon Corp. at its Blanco Vista open-pit mine, where 4 men were employed an average of 164 days. The expanding plant near the mine was operated 256 days, employing 5 men.

The value of output of gold, silver, copper, lead, and zinc in 1954 in Socorro County was 52 percent less than in 1953. Active mines in the county dropped to 7, compared with 15 in 1953. The drop in value and number of mines was due mainly to the closing down of many lead-zinc-silver mines and curtailment of operations at others.

The activities of the construction industry, with regard to its utilization of stone and sand and gravel, resulted in the quarrying of a small quantity of crushed basalt for riprap. Some paving gravel was produced by construction and maintenance crews of the New Mexico Highway Department.

Hansonberg District.—Portales Mining Co. operated its Louise-Halstead-Hansonberg-Prairie Spring group of open-pit lead mines throughout the year until October 20, 1954, when the mill burned and operations ceased. Smaller quantities of silver, copper, and zinc were recovered from the ore milled along with the lead. The Mex-Tex Mining Co. operated the Royal Flush mine, 5 miles south of Bingham. The ore mined from the open pit was trucked 35 miles to the company mill near San Antonio, where lead concentrate and ground barite were recovered.

Magdalena District.—The Lynchburg lead-zinc mine, owned by the New Jersey Zinc Co., Empire Zinc Division, the largest metal producer in the district in 1953, closed in September 1953 and was not reopened in 1954. This accounted for most of the drop in output in Socorro County. Robert W. Chamberlin mined and shipped copper ore from the Waldo mine under lease from the American Smelting & Refining

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Co. No lead-zinc ore was shipped from this mine, as in past years. Lead ore containing some copper, gold, and silver was shipped from the Mistletoe mine by J. D. Torres and from the Queen group by Sadie Papa. Copper ore, with a small quantity of silver, was mined and shipped to the El Paso smelter by the MacDonald & Dobson partnership from the Nitt mine, which was leased from the Tri-Bullion Corp.

Operators of 22 mines in Socorro County in 1954 shipped manganiferous material to the Deming, N. Mex. Government Purchase Depot. Of these mines, 17 shipped less than 100 long dry tons. The four larger mines were Blue Gold and Gloryana (operated by Clarence Barrett), Socorro Mountain (operated by Pioneer Construction Co. and Manganese Co. of Arizona), and Black Canyon (operated by Joe Granera).

Taos.—The mineral industry of the county remained relatively stable in 1954 compared with 1953. The most important mineral, in terms of value, was perlite, followed by molybdenum, beryl, mica, and silver.

F. E. Schundler & Co., Inc., operated its No Agua crude perlite property for 310 days, employing an average of 3 men in mining operations; in addition, 17 men were employed at the preparation plant for 310 days. The demand for perlite for concrete aggregate, oil-well drilling, and other uses continued its upward trend, and sales in 1954 gained 17 percent over the 1953 total.

The Questa Molybdenum mine (known locally as the Moly mine), 6 miles east of Questa, in the Taos Range of the Sangre de Cristo Mountains, Taos County, is unusual in containing high-grade molybdenite ore in fissure veins. Mining was by overhand, horizontal slicing in stull-supported stopes; the ore was concentrated by flotation. The molybdenum concentrate produced in 1954 was shipped to the company refining plant at Washington, Pa., where it was used to produce molybdenum oxide, ferromolybdenum, and other molybdenum products.

The D. H. A. Mining Co. shipped a small lot of silver ore from the Aztec group in the Picuris district, Taos County, in 1954.

As a result of a market for sheet mica at Custer, S. Dak., the county mica district reported activity for the first time in a number of years. The American Mining & Exploration Co. mined the U. S. Hill mica deposit, and several thousand pounds of hand-cobbed mica was shipped to Custer.

The Harding mine near Dixon, operated by Arthur Montgomery, was the largest producer of beryl in the State and the United States in 1954.

Union.—The output of pumice (scoria) was the only mining activity reported by the mineral industry of the region. All mining was centered around Des Moines, where the Twin Mountain Rock Co. operated the Twin Mountain pit, producing scoria for railroad ballast, and New Mexico Aggregate Co. produced material for use in concrete aggregate. The pits were worked 191 days, and an average of 7 men was employed.

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A new liquid carbon dioxide plant was completed and placed in operation during March by Gruemmer Indiana Carbonic, Inc. The plant is near Des Moines, and a spurline has been built connecting the plant to the Colorado & Southern Railroad.

Valencia.—Stone, perlite, sand and gravel, and gypsum were mined and sold in the county during 1954.

The Grants quarry, operated by the United States Gypsum Co., produced a large quantity of crude perlite in 1954. This property, formerly owned by the Pumice Corp. of America, was operated 297 days in 1954 and employed an average of 6 men. The processing plant was also operated 297 days, and 12 men were employed.

In addition to a small quantity of crushed basalt used in road construction, the Sharp & Fellows Construction Co. produced stone for concrete aggregate and railroad ballast.

The New Mexico Highway Department and the Federal Bureau of Reclamation were active in the county during 1954; as a result of contracts let by these agencies, a small tonnage of paving sand and gravel was produced by private contractors and highway department construction and maintenance crews. The Belen Sand & Gravel Co. also reported sales of structural and paving sand and gravel, as well as a small quantity of plaster sand.

Commercial production of gypsum in the State was reported for the first time since 1949. An open-pit deposit near Las Lunas was operated by White Eagle Gypsum Co., Inc., and the crude material was sold to local farmers.

The Anaconda Co. completed 2 spur connections to the Santa Fe Railway at Laguna and Bluewater, and rail shipments of ore from the Jackpile uranium mine to the Bluewater mill, a distance of 52 miles, became possible. Construction of an acid-leach mill began in May; enlargement of the carbonate-leach mill was also undertaken during the year.

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The Mineral Industry of New York

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, United States Department of the Interior, and the New York State Science Service, Office of Geology.

By Alvin Kaufman[1] and C. Geraldine Cleary[2]

THE VALUE of New York mineral production rose 3 percent in 1954 compared with 1953, primarily because of increased sand and gravel and salt output, accompanied by rises in the value of these 2 commodities. Of the 23 minerals produced in the State in 1954, portland cement, iron ore, stone, and sand and gravel were the most important from the standpoint of value. These minerals contributed 68 percent of the value of 1954 production. St. Lawrence, Erie, Essex, and Columbia Counties, primarily cement- or iron ore-producing areas, were the major sources of minerals.

Mineral operations of the State yielded industrial minerals (nonmetals), metals, and fuels. Industrial minerals were the most important group, supplying 69 percent of New York's mineral value. Metals ranked next in importance, with 25 percent of the value of output, followed by fuels, with the remaining 6 percent. Cement, stone, sand and gravel, and salt were the most important industrial minerals and contributed 93 percent of the nonmetal total (exclusive of fuels).

Iron-ore production composed 66 percent of the value of metal output; other metals included lead, silver, titanium concentrate, and zinc. In addition, some metals, such as bismuth and cadmium, were produced that cannot be accounted for metallurgically in early processing stages or credited to a particular mine or State of origin. These minor constituents are recovered at smelting plants treating mixtures of materials from many sources. Petroleum was by far the most important fuel, comprising 93 percent of the value of fuels output.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

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TABLE 1.—Mineral production in New York, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement, portland ..... 376-pound barrels	14,965,164	$39,388,183	14,496,876	$38,861,205
Clays	960,791	1,303,281	1,199,158	1,493,503
Emery	10,562	143,974	9,758	132,313
Gypsum	987,156	3,507,207	1,133,579	4,005,353
Iron ore (usable) ..... long tons, gross weight	3,414,859	36,346,279	[2] 2,802,873	[3] 31,706,570
Lead (recoverable content of ores, etc.)	1,435	375,970	1,187	325,238
Natural gas ..... million cubic feet	2,347	742,000	2,598	847,000
Peat	3,775	46,307	(3)	(3)
Petroleum (crude) ..... thousand 42-gallon barrels	3,800	16,260,000	3,257	11,140,000
Salt (common)	3,322,659	17,351,111	3,412,636	22,754,118
Sand and gravel	22,530,891	23,493,857	30,082,333	29,756,301
Silver (recoverable content of ores, etc.) ..... troy ounces	35,398	32,037	34,576	31,293
Slate	113,575	1,733,332	114,929	1,742,048
Stone	[4] 15,961,657	[4] 25,250,576	19,410,121	31,425,701
Talc	156,299	940,541	(3)	(3)
Zinc (recoverable content of ores, etc.)	51,529	11,851,670	53,199	11,490,984
Undistributed: Abrasive stone, beryllium concentrate (1954), natural cement, abrasive garnet, lime, calcareous marl, talc, titanium concentrate, wollastonite, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2). Excludes value of clays used for cement (1953)	----------	8,102,030	----------	9,908,988
Total New York	----------	186,868,000	----------	[5] 192,764,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Includes crude iron oxide pigment materials.
[3] Values included with "Undistributed."
[4] Incomplete figure. Crushed miscellaneous stone and limestone for cement and lime manufacture excluded. Value of crushed miscellaneous stone included with "Undistributed."
[5] Total has been adjusted to eliminate duplication in the value of clays and stone.

REVIEW BY MINERAL COMMODITIES

METALS

Iron Ore.—Production of crude ore dropped 15 percent, and usable ore shipments declined 18 percent in 1954 compared with 1953. Seventy-three percent of the total crude output was obtained from surface mines. Most of the usable ore output (86 percent) was shipped as sinter.

Six mines were active in 1954, as in previous years. The largest producing mine, by far, was the Jones & Laughlin Ore Corp. Benson mine near Starlake. This was followed by the MacIntyre mine of National Lead Co. near Tahawus and Republic Steel Corp. New Bed-Harmony-Old Bed mine at Mineville.

As a result of a temporary drop in ore demand for steel manufacture, Republic Steel Corp. closed its Chateaugay mine at Lyon Mountain from July 30 to September 13 and also shut down the Fisher Hill mine in February for the remainder of the year. The sintering plant and machine shops at Fisher Hill continued to operate.

The State production of usable iron ore was inadequate to meet the demand of the blast furnaces active in New York. These furnaces consumed 4,080,036 short tons of domestic iron ore, 2,017,219 short tons of sinter, and 701,733 short tons of imported ore and miscellaneous metalliferous materials. The furnaces in the State produced 3,658,099 short tons of pig iron. New York pig-iron output is concentrated

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principally in the Buffalo area because of the availability of iron ore and limestone from Michigan, the low-cost rail haul from Pennsylvania for coal and coke, and excellent rail, boat, and truck connections with nearby industrial markets. The iron ore and limestone are delivered alongside the blast furnaces by boats from the Lake Superior region. Companies active during 1954 were Bethlehem Steel Co., Lackawanna; Colorado Fuel & Iron Corp., Tonawanda; Hanna Furnace Corp., Buffalo; Republic Steel Corp., Buffalo and Troy; and Tonawanda Iron Division, American Radiator & Standard Sanitary Corp., North Tonawanda. All of the State's 47 open-hearth furnaces for the production of steel were also active in the Buffalo area.

TABLE 2.—Production and shipments of iron ore, 1945–49 (average) and 1950–54

Year	Number of mines	Crude ore mined (long tons)	Usable ore shipped (long tons)	Value
1945–49 (average)	7	5,680,392	2,143,254	$17,839,705
1950	7	6,722,422	2,917,257	27,914,818
1951	7	7,741,434	3,649,531	39,819,368
1952	6	7,267,202	2,896,531	34,514,879
1953	6	8,691,395	3,414,859	36,346,279
1954	6	7,396,516	2,802,873	31,706,570

TABLE 3.—Capacity of blast furnaces and steelmaking furnaces, January 1, 1955, by companies and location, in net tons [1]

Company and location	Blast furnaces		Steel capacity				
			Open hearth		Electric and crucible		Total
	Number	Capacity	Number	Capacity	Number	Capacity	Capacity
Buffalo:							
Hanna Furnace Corp	4	850,000					
Republic Steel Corp	2	618,000	9	882,000			882,000
Cortland: Wickwire Brothers, Inc					1	20,800	20,800
Dunkirk: Allegheny Ludlum Steel Corp					3	33,000	33,000
Lackawanna: Bethlehem Steel Co	7	3,036,000	34	5,100,000			5,100,000
Lockport: Simonds Saw & Steel Co					3	21,600	21,600
North Tonawanda: Tonawanda Iron Division	1	165,000					
Syracuse: Crucible Steel Co. of America					6	59,600	59,600
Tonawanda:							
Allegheny Ludlum Steel Corp					3	4,500	4,500
Colorado Fuel & Iron Corp	2	390,000	4	252,000			252,000
Troy: Republic Steel Corp	1	263,000					
Watervliet: Allegheny Ludlum Steel Corp					7	77,000	77,000
Total	17	5,322,000	47	6,234,000	23	216,500	6,450,500

[1] Adapted from American Iron and Steel Institute, Annual Capacities of Coke Ovens, Blast Furnaces and Steelmaking Furnaces as of Jan. 1, 1955, by companies, States, and districts (United States) January, 1955, pp. 8, 18

Lead.—Mine production of lead, measured in terms of recoverable metal, declined 17 percent in 1954 compared with 1953. The lead was recovered from predominantly zinc ore produced by the Balmat mine of the St. Joseph Lead Co. in St. Lawrence County. The lead content of the ore may vary materially from year to year, and there-

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fore the fluctuation in lead output was not significant; the quantity of ore mined and of recoverable zinc produced was larger than in 1953.

Silver.—Production of silver, all as a byproduct of lead and zinc output at St. Joseph Lead Co. Balmat mine, declined 2 percent in 1954 compared with 1953.

Titanium Concentrate.—Titanium concentrate continued to be produced by National Lead Co. at its MacIntyre mine in Essex County. Ilmenite was recovered as a coproduct of iron ore.

Zinc.—The output of zinc increased 3 percent over 1953 and established a new record high of 53,199 tons. This rise was opposite to the national experience; United States output of zinc reached the lowest point since 1934. New York production continued to come from the St. Joseph Lead Co. Balmat and Edwards mines at Balmat and Edwards, respectively, in St. Lawrence County. These 2 ranked among the 25 leading zinc-producing mines in the Nation in 1954, with Balmat ranking 2d in output and Edwards 11th.

During the spring of 1954 a biogeochemical study was made of the Shawangunk mine, Wurtsboro, to test the effectiveness of this type of analysis in exploring for lead and zinc ore bodies. The mine is a fissure vein-type lead-zinc deposit containing minor amounts of copper. Copper and zinc were determined in common white-birch twigs by modifications of the H. V. Warren method. The technique of E. D. Sandell, with changes, was used to determine the quantity of lead available. Results were calculated and tabulated for parts per million of copper, zinc, and lead and for the copper-zinc ratio. The lead and copper-zinc ratio values showed encouraging results in defining the ore body as to content and possible shape.[3]

TABLE 4.—Mine production of silver, lead, and zinc, 1945–49 (average) and 1950–54, in terms of recoverable metals

Year	Mines producing	Material sold or treated (short tons)	Silver		Lead		Zinc		Total value
			Troy ounces	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	3	424,683	17,926	$15,364	1,196	$333,979	32,830	$8,109,306	$8,458,649
1950	3	494,871	32,628	29,530	1,484	400,680	38,321	10,883,164	11,313,374
1951	2	500,490	47,568	43,051	1,500	519,000	40,051	14,578,564	15,140,615
1952	2	437,099	38,895	35,202	1,120	360,640	32,636	10,835,152	11,230,994
1953	2	646,041	35,398	32,037	1,435	375,970	51,529	11,851,670	12,259,677
1954	2	662,665	34,576	31,293	1,187	325,238	53,199	11,490,984	11,847,515

NONMETALS

Abrasive Stones.—Millstones were produced near High Falls, Ulster County, by Frend Bush in 1954. Output was considerably less than in 1953.

Cement.—The manufacture of portland cement remained, in point of value, the major mineral industry in New York in 1954; however, production dropped 3 percent in 1954 compared with the previous year as a result of a 6-week labor strike that was settled on June 27.

There were 10 portland-cement and 2 natural-cement plants active

[3] Worthington, Joseph, Biogeochemical Prospecting at the Shawangunk Mine—a Case Study: Econ. Geol., vol. 50, No. 4, June–July 1955, pp. 420–429.

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in New York during the year. The largest of these were the Lehigh Portland Cement Co., Buffalo; the Universal Atlas Cement Co. plant near Hudson; and Federal Portland Cement Co., Inc., operations, Hamburg. All cement operations in the State, except the Lehigh Portland Cement Co., Buffalo, and Federal Portland Cement Co., Inc., Hamburg, mined their limestone in New York.

Alpha Portland Cement Co. announced an $8 million expansion program at the Alsen quarry and mill. The company anticipated elimination of the overhead tram from the quarry to the mill in favor of a continuous conveyor-belt system. North American Cement Corp. began expanding its Howes Cave plant from 3,000 barrels of cement per day to 4,500 barrels. The first phase of this program was installation of a fourth kiln and enlargement of the kiln building. New coal mills, grinding facilities, increased storage facilities, clinker coolers, coal bunkers, and dust-collecting equipment will be added. Quarry facilities also were expanded and the crusher and hammer mills relocated. The stone mill will contain a new Traylor ball mill.[4] Century Cement Mfg. Co., Inc., Rosendale, Ulster County, continued to produce natural cement in New York in 1954. Louisville Cement Co. of New York, Akron, Erie County, produced prepared masonry cement. These two companies utilized impure magnesian limestones.

TABLE 5.—Shipments of portland cement, 1945–49 (average) and 1950–54

Year	Barrels	Value	Year	Barrels	Value
1945–49 (average)	10, 533, 058	$20, 434, 566	1952	14, 624, 274	$36, 679, 379
1950	13, 271, 469	30, 895, 295	1953	14, 965, 164	39, 388, 183
1951	13, 862, 522	34, 687, 090	1954	14, 496, 876	38, 861, 205

Clays.—Production of clays in New York increased 25 percent in 1954 compared with 1953; 18 pits were active in 8 counties. Jova Brick Works, Orange County, and Star Brick Corp., Ulster County, were the major producers. Ulster and Albany Counties, which together supplied 35 percent of the total clays output in the State, were the largest producers. Virtually all of New York's output consisted of miscellaneous clay for heavy clay-products manufacture. A small quantity of slip clay for abrasives manufacture, however, was produced by Rex Clay Products Co., Inc., Albany County. This material was utilized in manufacturing carborundum and emery abrasives. There was also a small output of pottery clays from Onondaga County.

The Onondaga Brick Corp. began producing an expanded lightweight shale aggregate from a new plant near Warners. When operating on a round-the-clock schedule, this plant will be able to produce an estimated 600 cubic yards of bulk aggregate daily. The plant will utilize a 66-foot Sintering Machinery Corp. hearth.

Emery.—The output of emery in New York in 1954 declined 8 percent compared with 1953. Production was obtained from the DeLuca No. 1 and No. 2 mines near Peekskill and Croton and from the Kingston mine near Croton. Production from the DeLuca mines was shipped to Peekskill by truck for crushing and grading. Kingston

[4] Rock Products, April 1954, vol. 57, p. 81.

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mine output was forwarded to Chester, Mass. The State output was used in manufacturing emery aggregate, abrasives, and concrete flooring.

TABLE 6.—Emery sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1945–49 (average)	6,031	$66,886	$11.09	1952	10,352	$141,911	$13.71
1950	5,949	75,308	12.66	1953	10,562	143,974	13.63
1951	11,634	160,212	13.77	1954	9,758	132,313	13.56

Garnet, Abrasive.—Garnet was produced by Barton Mines Corp., North Creek, and Cabot Carbon Co., Willsboro. The Barton mine is one of the world's largest active garnet mines. The Fox Knolls (formerly the Bristol Mountain and Willsboro mines) operation of Cabot Carbon Co. produces garnet as a byproduct of wollastonite production. New York garnet output was sold principally for sandpaper, glass grinding, and polishing uses.

Gypsum.—Production of gypsum in New York increased 15 percent in 1954 compared with 1953. The United States Gypsum Co. and National Gypsum Co. operations near Oakfield and Clarence Center, respectively, remained the major producers of crude gypsum in the State. Ruberoid Co. purchased the mine and calcining plant of Ebsary Gypsum Co., Inc., at Wheatland, Monroe County. The new owners assumed control of this plant on August 12. Other producers active in 1954 were Certain-teed Products Corp., Akron, and Universal Atlas Cement Co., Clarence Center. Calcined gypsum was produced at each of the above plants except that of Universal Atlas Cement Co. Crude gypsum imported from New Brunswick and Nova Scotia was treated in the calcining plants of National Gypsum Co., Bronxville, and United States Gypsum Co., New Brighton.

TABLE 7.—Production of crude gypsum, 1945–49 (average) and 1950–54

Year	Active mines	Short tons	Value	
			Total	Average per ton
1945–49 (average)	7	893,350	$2,387,473	$2.67
1950	6	1,280,100	3,876,176	3.03
1951	5	1,259,484	4,010,766	3.18
1952	5	1,143,920	3,816,148	3.34
1953	5	987,156	3,507,207	3.55
1954	5	1,133,579	4,005,353	3.53

Iron Oxide Pigments.—Natural red iron oxide pigments were produced in New York in 1954 by Clinton Metallic Paint Co., Oneida County, and Rossie Iron Ore Co., St. Lawrence County.

Lime.—Quicklime and hydrated lime were produced in New York in 1954 for chemical, industrial, agricultural, and building purposes.

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The largest producer was the Kelley-Island Lime & Transport Co., Erie County. The Chazy Lime & Stone Co., Inc., was reorganized and renamed International Lime & Stone Corp. early in 1954. The plant at Chazy was completely rebuilt; and the first unit, which had an 80-ton daily capacity, was in production by the end of the year.[5]

Marl (Calcareous).—Calcareous marl for agricultural uses was produced in New York in 1954 by Louis J. Johnston from a deposit in Livingston County.

Perlite.—Expanded perlite was manufactured in four plants from crude material shipped from the southwestern United States. The National Gypsum Co. began operating a plant in Erie County in March of 1954. Penn Industries, Inc., Queens, announced sale of its plant to the New Jersey Perlite Corp.

Expanded perlite produced was utilized for plaster and concrete aggregate and in manufacturing insulating and fertilizer materials. The output rose from 6,515 short tons valued at $382,173 in 1953 to 11,492 short tons valued at $444,166 in 1954.

Salt.—Production of salt was one of New York's major mineral industries. Evaporated and rock salts and brine were produced. Output increased 3 percent in 1954 compared with the previous year. The average value per short ton of all types of salt sold or used by producers in 1954 increased to $6.67 compared with $5.22 in 1953. Of the seven producers active in the State in 1954, Allied Chemical & Dye Corp., Solvay Process Division, Tully, and International Salt Co., Inc., Retsof, were the largest. Salt was produced in Livingston, Onondaga, Schuyler, Tompkins, and Wyoming Counties.

TABLE 8.—Salt sold or used by producers, 1945–49 (average) and 1950–54

Year	Evaporated		Rock and brine		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	447,251	$5,344,397	2,476,071	$6,280,030	2,923,322	$11,624,427
1950	487,245	6,375,966	2,319,682	8,029,396	2,806,927	14,405,362
1951	502,216	6,419,061	3,016,499	10,133,829	3,518,715	16,552,890
1952	508,317	6,674,698	2,909,126	10,071,764	3,417,443	16,746,462
1953	532,924	7,832,362	2,789,735	9,518,749	3,322,659	17,351,111
1954	529,602	8,734,524	2,883,034	14,019,594	3,412,636	22,754,118

Sand and Gravel.—New York sand and gravel output increased 34 percent in 1954 compared with 1953. Most of the State production (93 percent) was obtained from commercial operations. The remaining 7 percent was produced by various Government agencies or their contractors. The principal use of New York sand and gravel was for structural purposes (56 percent), followed by paving uses (35 percent). Sand for molding and filter purposes and sand and gravel for miscellaneous uses consumed the remaining 9 percent. Major sand-and-gravel-producing counties were Nassau, Suffolk, Erie, and Onondaga, which together were responsible for 61 percent of the State output.

[5] Rock Products, vol. 57, March 1954, p. 104.

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TABLE 9.—Sand and gravel sold or used by producers, 1953–54, by classes of operations and uses

	1953		1954	
	Short tons	Value	Short tons	Value
COMMERCIAL OPERATIONS				
Sand:				
Molding	292,915	$835,498	271,477	$720,879
Building	6,050,568	6,535,419	10,280,834	9,468,050
Paving	5,120,423	5,193,269	4,577,719	4,616,755
Filter	62,789	61,118	28,176	36,726
Other	174,866	102,855	1,452,726	564,453
Gravel:				
Building	3,463,115	4,767,410	6,611,586	9,089,761
Paving	3,721,360	3,980,578	3,865,249	3,964,047
Other	501,196	283,853	650,598	386,319
Undistributed	78,362	44,551	113,656	86,603
Total commercial sand and gravel	19,465,594	21,804,551	27,852,021	28,933,593
GOVERNMENT-AND-CONTRACTOR OPERATIONS[1]				
Sand:				
Building	56,887	30,588	17,195	4,157
Paving	199,768	41,054	171,499	49,391
Gravel:				
Building	94,326	15,119	73,219	6,417
Paving	2,714,316	1,602,545	1,968,399	762,743
Total Government-and-contractor sand and gravel	3,065,297	1,689,306	2,230,312	822,708
Grand total	22,530,891	23,493,857	30,082,333	29,756,301

[1] Includes figures for State, counties, municipalities, and other Government agencies.

Slate.—New York slate production was concentrated in the Granville, Hampton, and Slateville areas in Washington County. Although a variety of colored slates is produced, New York red slates are unique. The other colors, such as green, purple, gray, black, and variegated, are common to both New York and Vermont. The State output was used for roofing, structural, sanitary, flagging, and flooring purposes. The output of roofing slates dropped in 1954 compared with 1953, primarily because of competition from artificial roofing materials, but the production of slates for other uses increased 1 percent. The average value of roofing slate increased from $35.40 per square in 1953 to $44.95 per square in 1954. The average value of slate for flagging, granules and flour, and other uses declined from $15.12 in 1953 to $15.08 in 1954. Of the 13 companies active in 1954, Central

TABLE 10.—Slate sold by producers, 1948–54

Year	Operators	Roofing		Flagging, granules, flour, and other uses		Total value
		Squares (100 square feet)	Value	Short tons	Value	
1948	13	3,730	$91,988	124,120	$1,440,892	$1,532,880
1949	16	280	12,616	122,075	1,604,481	1,617,097
1950	21	800	38,874	150,860	2,015,851	2,054,725
1951	19	450	19,580	125,880	1,980,526	2,000,106
1952	20	600	21,456	125,694	1,789,409	1,810,865
1953	20	566	20,037	113,345	1,713,295	1,733,332
1954	13	242	10,879	114,832	1,731,169	1,742,048

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Commercial Co. was the largest tonnage producer. This company produced flour and granules for roofing-granule manufacture.

Stone.—Limestone, marble, basalt, and miscellaneous stone were crushed and broken for sale in New York in 1954. The major portion of the stone yielded by New York quarries was sold for highway construction, concrete aggregate, and railroad ballast. Sandstone, granite, and miscellaneous stone were also quarried for building, curbing, and flagging. Limestone was the principal stone produced in 1954 and constituted 82 percent of total value of stone output. The major stone-producing counties were, in order of decreasing value, Rockland, Dutchess, and Onondaga. Of the 66 producers active during the year, 46 were limestone, 9 were sandstone, 6 miscellaneous stone, and 3 basalt; 2 produced marble and granite, respectively.

New York Trap Rock Corp. dedicated a new $1 million stone-crushing plant at Haverstraw on May 10. This plant will be capable of producing rock ranging in size from 2½ inches to pulverized limestone for use as a binder in constructing street surfaces. The company also embarked on a $1 million barge building program to carry stone materials down the Hudson River. The company in 1954 owned 176 barges, which transported approximately one-third of the total tonnage moving on the river.

TABLE 11.—Stone sold or used by producers, 1953–54, by uses

Use	1953		1954	
	Short tons	Value	Short tons	Value
Dimension stone:				
Building stone	12,932	$389,632	12,826	$417,377
Curbing and flagging	13,651	239,748	18,267	457,882
Total dimension stone	26,583	629,380	31,093	875,259
Crushed and broken:				
Riprap	141,350	313,953	309,499	769,300
Crushed stone	[1] 12,190,747	[1] 19,009,337	13,745,470	23,561,950
Furnace flux	131,942	184,867	94,487	123,625
Agricultural	983,161	1,893,247	307,859	949,662
Other [2]	[1] 2,487,874	[1] 3,219,792	2,148,177	2,714,171
Limestone for cement and lime	[3]	[3]	2,773,536	2,431,734
Total crushed and broken	[1] 15,935,074	[1] 24,621,196	19,379,028	30,550,442
Grand total	[1] 15,961,657	[1] 25,250,576	19,410,121	31,425,701

[1] Incomplete total to avoid disclosure of individual company operations.
[2] Includes terrazzo and pulverized marble, miscellaneous limestone uses.
[3] Data not available.

Talc.—In 1954 only two companies produced talc in New York. Gouverneur Talc Co., Inc., and International Talc Co., Inc., operated mines near Gouverneur. Their output was sold for use in paints, ceramics, and floor and wall tile and for miscellaneous purposes. The Arnold No. 1, Woodcock No. 3, and Ontario No. 4 mines, formerly owned by W. H. Loomis Talc Co., were closed during the year. International Talc Co., purchaser of the former Loomis properties, continued to operate the Loomis grinding mills. Reynolds Talc Co. began development operations at an open-pit mine and mill on the

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east end of the Talcville area. It was anticipated this company would begin production early in 1955.

Vermiculite.—Exfoliated vermiculite was produced by the Zonolite Co. in Albany from material imported from the western United States.

Wollastonite.—Cabot Carbon Co. of Boston, Mass., continued to operate the Fox Knoll mine and mill for the production of wollastonite. This material was refined and sold as a filler in manufacturing paint, ceramics, and plastics.

MINERAL FUELS

Peat.—New York peat production was obtained from three bogs in Seneca and Dutchess Counties. The output of these bogs was humus, peat moss, or reed or sedge peat.

Petroleum and Natural Gas.—A total of 435 wells was completed in New York in 1954. Of these, 217 produced oil, 2 yielded gas, 213 were service walls, and 3 were dry holes. The average footage drilled was 1,446 feet. Of the total number of wells drilled, 431 were less than 2,500 feet deep, and 4 had footage in the 2,500- to 5,000-foot classification. No wells were drilled past the 5,000-foot depth in New York State in 1954. According to the American Gas Association and American Petroleum Institute, estimated proved recoverable reserves of crude oil, as of January 1, 1955, were 46 million barrels. Natural gas reserves, proved recoverable, as of January 1, 1955, were estimated at 69 billion cubic feet. During 1954 the Socony-Vacuum Oil Co., Inc., sold its 7,150 barrel refinery at Olean to C. J. Simpson Drilling Co. The plant, one of the oldest in the United States, closed in May 1954 because of the decreased supply of crude oil available in the area. The Simpson Co. will dismantle the plant and ship part of it to Cuba. The 112-acre tract, including several buildings, will be sold.

TABLE 12.—Petroleum production, 1945–49 (average) and 1950–54

Year	Thousand barrels (42 gallons)	Value (thousand dollars)	Year	Thousand barrels (42 gallons)	Value (thousand dollars)
1945–49 (average)	4,664	18,946	1952	4,242	17,940
1950	4,143	15,660	1953	3,800	16,260
1951	4,254	17,990	1954	3,257	11,140

REVIEW BY COUNTIES

Albany.—Stone, sand and gravel, and clays were the mineral products of Albany County in 1954, in order of decreasing value of output. Plant No. 1 of Callanan Road Improvement Co., South Bethlehem, produced crushed and broken limestone for riprap, blast-furnace flux, concrete aggregate, roadstones, railroad ballast, and miscellaneous uses. Julian Bocchi's Grippy quarry at East Berne was idle in 1954. During the year eight commercial sand and gravel operations were active. Albany Gravel Co., Inc., worked its pits at Cedar Hill, South Bethlehem, Loudonville, and Van Rensselaer and produced building and paving material. Selkirk Moulding Sand Co., Inc., and Whitehead Bros. Co. recovered molding sand from their pits at Selkirk and Slingerlands, respectively. Clay production in 1954 was

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limited to fire and miscellaneous clay for manufacturing brick and other heavy clay products. Powell & Minnock Brick Works, Roah Hook Brick Co., and Sutton & Suderley Brick Co., all at Coeymans; and Rex Clay Products Co., Inc., Albany, were the active producers.

TABLE 13.—Value of mineral production in New York, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value
Albany	$2,471,308	$1,580,180	Stone, sand and gravel, clays.
Allegany	304,930	248,398	Sand and gravel.
Broome	524,855	660,280	Sand and gravel, stone, clays.
Cattaraugus	410,008	555,147	Sand and gravel.
Cayuga	(2)	374,168	Stone, sand and gravel.
Chautauqua	180,099	428,462	Sand and gravel.
Chemung	(2)	(2)	Do.
Chenango	(2)	(2)	Do.
Clinton	(2)	(2)	Iron ore, stone, lime, sand and gravel.
Columbia	11,385,987	(2)	Cement, stone, sand and gravel.
Cortland	110,253	(2)	Sand and gravel.
Delaware	354,703	538,163	Stone, sand and gravel.
Dutchess	(2)	6,789,050	Stone, sand and gravel, peat.
Erie	17,280,473	[3] 20,601,838	Cement, sand and gravel, gypsum, stone, natural cement, lime, clays.
Essex	(2)	16,924,270	Iron ore, titanium concentrate, sand and gravel, wollastonite, garnet.
Franklin	(2)	107,398	Stone, sand and gravel.
Fulton	34,117	207,160	Sand and gravel.
Genesee	3,141,287	[3] 2,308,134	Gypsum, stone, sand and gravel.
Greene	8,428,314	8,954,732	Cement, stone, sand and gravel.
Herkimer	359,933	793,135	Stone, sand and gravel.
Jefferson	(2)	810,096	Do.
Kings	(2)	(2)	Sand and gravel.
Lewis	7,069	56,022	Stone, sand and gravel.
Livingston	6,256,373	7,617,866	Salt, sand and gravel, calcareous marl.
Madison	(2)	275,562	Stone.
Monroe	1,568,119	1,372,408	Sand and gravel, gypsum, stone.
Montgomery	(2)	276,651	Stone, sand and gravel.
Nassau	7,385,983	7,373,606	Sand and gravel, clays.
Niagara	(2)	748,661	Stone, sand and gravel.
Oneida	(2)	(2)	Stone, sand and gravel, iron ore.
Onondaga	6,144,281	9,862,286	Salt, stone, cement, sand and gravel, clays.
Ontario	(2)	634,343	Sand and gravel, stone.
Orange	470,513	1,001,949	Sand and gravel, clays.
Orleans	(2)	(2)	Sand and gravel.
Oswego	(2)	(2)	Do.
Otsego	64,300	(2)	Do.
Putnam	(2)	(2)	Stone, sand and gravel.
Rensselaer	(2)	259,132	Stone, clays, sand and gravel.
Rockland	5,413,291	8,778,086	Stone, sand and gravel.
St. Lawrence	(2)	(2)	Iron ore, zinc, talc, lead, stone, sand and gravel, silver, lime.
Saratoga	752,992	698,022	Sand and gravel, stone, beryllium concentrate.
Schenectady	441,031	(2)	Sand and gravel.
Schoharie	2,275,616	(2)	Cement, stone.
Schuyler	3,952,583	4,509,717	Salt, sand and gravel.
Seneca	(2)	(2)	Peat.
Steuben	267,277	262,582	Sand and gravel.
Suffolk	4,550,090	5,903,448	Do.
Sullivan	(2)	293,411	Do.
Tioga	(2)	(2)	Do.
Tompkins	4,007,858	(2)	Salt, sand and gravel, stone.
Ulster	1,115,017	3,357,460	Natural cement, stone, clays, sand and gravel, abrasive stone.
Warren	4,632,896	[3] 5,539,246	Portland cement, garnet, stone, sand and gravel.
Washington	(2)	1,977,815	Slate, stone, sand and gravel.
Wayne	15,878	27,026	Sand and gravel.
Westchester	(2)	1,013,647	Stone, sand and gravel, emery, beryllium concentrate.
Wyoming	1,951,648	(2)	Salt, stone, sand and gravel.
Yates	3,934	(2)	Sand and gravel.
Undistributed [3] [4]	90,604,165	69,044,676	
Total	186,868,000	192,764,000	

[1] The following counties are not listed because no tonnage was reported: Hamilton, New York, Queens, and Richmond.
[2] Value included with "Undistributed."
[3] Excludes limestone and clay used to manufacture cement and lime.
[4] Includes petroleum and natural gas.

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Allegany.—The sand and gravel pits at Alfred Station, owned by Alfred-Atlas Gravel & Sand Corp. and Buffalo Slag Co., Inc., produced building and paving material, as did Thomas Moogan of Friendship.

Broome.—In 1954 three commercial sand and gravel producers were active in Broome County. Varney & Dickenson, Inc., Royal Winne, and Binghamton Crushed Stone & Gravel Co., Binghamton, recovered structural sand and gravel from their pits. Royal Winne produced material from the Vestal pit, which was used for local building purposes. Binghamton Brick Co., Inc., Binghamton, produced miscellaneous clay for use in heavy clay products. Operations at this plant were disrupted for a short period during the summer owing to a fire caused by a short circuit and the ignition of oil drippings. W. R. Strong & Sons near Deposit quarried dimension sandstone for flagging. Corbisello Quarries, Inc., discontinued operations in 1954.

Cattaraugus.—Building and paving sand and gravel were produced at the Allegany and Franklinville plants of the Buffalo Slag Co., Inc. E. F. Lippert & Co., and William Lippert, both near Allegany; V. W. Clark & Son, Limestone; Olean Gravel, Inc., Machias; Upper Allegheny Sand & Gravel Co., Inc., Onoville; and Ray Vogtli & Son, Gowanda, also produced sand and gravel.

Cayuga.—Mineral production in Cayuga County in 1954 was limited to sand and gravel and stone. Crushed and broken limestone for use in highway and railroad construction and for riprap was recovered from the Auburn quarry of General Crushed Stone Co. Building sand and gravel was obtained from J. J. Harrington pit at Sennett.

Chautauqua.—Evans Builders Supply was the largest commercial sand and gravel operator in Chautauqua County in 1954. This company operated a wet pit and fixed preparation plant at Silver Creek. W. Lee Bull, Inc., with a pit and fixed plant near Jamestown, also produced sand and gravel, as did Seybold Bros., Inc., Dunkirk; John J. Mahoney Sand & Gravel Co., Falconer; and Frank Sack, Bemus Point.

Chemung.—Three commercial sand and gravel producers were active in Chemung County in 1954. Elmira Transit Mix, Inc., Horseheads, produced structural and paving sand and gravel at its pit and fixed plant. Dalrymple Gravel & Contracting Co., Inc., mined and processed sand and gravel at its bank near Elmira. Sand and gravel for building purposes was produced at the pit and fixed plant of Frank Treat, Breesport.

Chenango.—The only mineral commodity produced in Chenango County in 1954 was sand and gravel recovered by Bundy Concrete Co., Sherburne, and B & B Building Supplies, Greene.

Clinton.—Iron ore, stone, lime, and sand and gravel were produced in Clinton County during 1954. Iron ore ranked first in value, representing over 90 percent of the total. The Chateaugay underground and open-pit mine of Republic Steel Corp. continued to produce magnetite iron ore. This property ranked fourth among the iron ore mines of New York. International Lime & Stone Corp., formerly Chazy Lime & Stone Co., Inc., quarried crushed limestone for use in highway maintenance and agricultural purposes. This

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company also produced quicklime and hydrated lime for chemical uses at its Chazy plant. Miscellaneous crushed stone for road construction and railroad ballast was produced as a byproduct by the Chateaugay mine of Republic Steel Corp. Sand and gravel for highway maintenance was produced at several pits in the county by the Clinton County Highway Department, Plattsburg, and State of New York Department of Public Works.

Columbia.—Columbia County ranked as the second largest cement-producing area in the State in 1954. Universal Atlas Cement Co. and Lone Star Cement Corp. continued to operate their limestone quarries and cement plants near Hudson and Greenport, respectively. Lone Star Cement Corp. modernized its plant by installing a storage crane, quarry truck, quarry railroad car, ventilating monitor, and car shake-out for coal cars and rehabilitating the No. 4 kiln. A. Colarusso & Son produced crushed limestone for highway maintenance and agricultural purposes. Columbia Sand & Gravel Corp. and F. H. Stickles & Son produced building and paving sand and gravel from their pits at Claverack and Livingston, respectively. Whitehead Bros. Co. continued to produce naturally bonded molding sand in 1954.

Cortland.—Building and paving sand and gravel were produced by Eldredge Sand & Gravel Corp. near Homer for most of the year. The No. 1 plant was sold at auction on November 3, 1954, and the No. 2 plant was sold to John J. Bero, Buffalo, N. Y., on November 1, 1954. This action was necessitated by the death of the former owner, Fred H. Eldredge. Cortland Ready Mix Concrete Co. of Cortland and the Cortland County Highway Department also produced building and paving sand and gravel.

Delaware.—Rough and dressed sandstone for building construction was quarried from the North River quarry of American Bluestone Co. near Unadilla. Some of it was used in erecting buildings at Hunter College, New York City; Ford Clinic Building, Detroit, Mich.; State Capitol Building, Albany; Olin Hall, Cornell Medical College, Albany; and St. Lawrence College, Canton, N. Y. Other dimension-sandstone producers in Delaware County in 1954 included Johnston & Rhodes Bluestone Co., East Branch; W. R. Strong & Sons, Deposit; and Earl Tomkins, Hancock. Delaware County Highway Department produced a small tonnage of sand and gravel for highway maintenance.

Dutchess.—Limestone exceeded all other mineral products in value in Dutchess County in 1954. The largest active quarry was the New York Trap Rock Corp. Clinton Point quarry near New Hamburg. Output was used chiefly for riprap, highway and railroad maintenance, and miscellaneous uses. Dutchess Quarry & Supply Co., Inc., produced crushed limestone for concrete and road material at its quarry near Poughkeepsie. Eleven commercial sand and gravel pits were in operation during 1954. Producers during 1954 included Hosner Mountain Sand & Stone Corp., Gayhead; David Alexander, Wrappingers Falls; Amenia Sand & Gravel Co., Amenia; Dutchess Quarry & Supply Co., Inc., Clinton Corners; and Fishkill Builders' Supply Corp., Beacon. The Black Fox Humus Corp. produced humus peat in 1954. It was used largely as a soil conditioner, as litter for barns and poultry yards, and as a packing material for plants, shrubbery, and other items.

Erie.—Erie County ranked first in gypsum, lime, and portland-cement production in New York, second in natural-cement production, and

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second in total value of mineral output among New York counties in 1954. Natural gas, sand and gravel, stone, and clays were also produced. The largest of the county's three gypsum producers was National Gypsum Co., which worked its mine and plant at Clarence Center. Certain-teed Products Corp. and Universal Atlas Cement Co. were also active producers of gypsum. Federal Portland Cement Co., Inc., and Lehigh Portland Cement Co. produced portland cement at plants at Hamburg and Buffalo, respectively. Federal Portland Cement Co., Inc., installed an additional Allis-Chalmers cement mill in April. Louisville Cement Co. of New York produced masonry cement at its plant near Akron. The largest clay producer in Erie County in 1954 was the Lake View pit of Acme Shale Brick Co., Inc. John H. Black Co., East Aurora, and Buffalo Brick Corp., West Falls, also mined clays. The county output was utilized in manufacturing drain tile, building brick, and other heavy clay products. The Cheektowaga plant of Buffalo Perlite Corp. and the Clarence Center plant of National Gypsum Co. produced expanded perlite. Kelley Island Lime & Transport Co., the largest lime producer in New York in 1954, produced quicklime and hydrated lime for chemical, building, and agricultural purposes at its plant in Buffalo. Clarence Sand & Gravel Corp. worked its pit at Clarence and produced building sand and gravel. Buffalo Sand Co., Inc., worked its fixed plant and pit near Lancaster and produced building and paving sand and gravel. Other sand and gravel producers included Pine Hill Concrete Mix Corp., Lancaster; Pfohl Bros., Inc., Cheektowaga; and Gravel Products Corp. on Lake Erie near Buffalo. Buffalo Crushed Stone Corp. merged with Frontier Industries, Inc., of Buffalo, effective October 15, 1954. These companies produced crushed limestone for highway and railroad maintenance and for bituminous mixes. The Cheektowaga quarry of Federal Crushed Stone Corp., which did not operate during the winter months, produced crushed and broken limestone for riprap, concrete, road material, and railroad ballast.

Essex.—Essex County continued to rank first in usable iron-ore output among the counties in New York in 1954. The mines of Essex County also continued to be the principal domestic source of wollastonite and supplier of titanium (ilmenite) concentrate. During the year National Lead Co. recovered iron ore and titanium concentrates from titaniferous magnetite ores at its MacIntyre mine and mill at Tahawus. This property rose from the fourth largest producer of iron ore in New York State in 1953 to second place in 1954. Republic Steel Corp. worked its New Bed-Harmony-Old Bed mines near Mineville throughout the year. Fisher Hill mine suspended operations temporarily on March 14. Cabot Carbon Co. produced wollastonite for use as a paint, ceramic, and plastic filler. Garnet was also yielded by this mine as a byproduct. The property, operated by Cabot Carbon Co., was formerly Northern Minerals, Inc. Saranac Lake Sand & Gravel Co., Inc., and Clarence G. Brooks, both of Saranac Lake, produced sand and gravel.

Franklin.—Stone and sand and gravel were the only mineral products of Franklin County in 1954. Structural sand and gravel was produced from a pit and fixed plant near Malone by L. & F. Paro. Paul Smiths College, Paul Smiths, produced paving gravel.

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Fulton.—Eight commercial sand and gravel plants were in operation in Fulton County in 1954. E. G. Delia & Sons Construction Corp. worked its pit and fixed plant at Northville and produced paving sand and gravel. Edward Bradt, Gloversville, and John Y. Edwards, north of St. Johnsville, produced bank-run gravel for maintenance of county roads. Other producers during the year included Harry R. Becker, Johnstown; Fred Machold, Broadalbin; and A. Frederick, Art Stone Co., and E. Arsenrule, all of Gloversville.

Genesee.—The leading mineral produced in Genesee County in 1954, in terms of value, was gypsum. The United States Gypsum Co. mine and plant near Oakfield was the only producer of crude material during the year. Batavia Washed Sand & Gravel Co., Inc., with a pit and fixed plant at Batavia, produced structural and paving sand and gravel. Sand and gravel for highway maintenance was produced at pits in the county by the State of New York Department of Public Works. Stone produced in Genesee County in 1954 was limited to crushed limestone for highway and railroad maintenance. The North LeRoy quarry of the General Crushed Stone Co., LeRoy; Genesee Stone Products Corp., Stafford; and LeRoy Lime & Crushed Stone Corp., LeRoy, were the active producers in 1954.

Greene.—The Catskill plant of North American Cement Corp., the Cementon plant of Alpha Portland Cement Co., and the Alsen plant of Lehigh Portland Cement Co. produced portland cement. North American Cement Corp. and Lehigh Portland Cement Co. were closed by a labor strike for 50 and 63 days, respectively.

Lawrence Bros. recovered paving and road sand and gravel from its Windham pit. Whitehead Bros., with pits at Catskill and Coxsackie, produced molding sand.

Herkimer.—The Jordanville quarry of General Crushed Stone Co. yielded crushed limestone for road construction and agricultural purposes. Newport Quarries, Inc., worked a limestone quarry at Newport for production of riprap, road material, and agricultural stone. Structural and paving sand and gravel was produced by Eastern Rock Products, Inc., Barneveld, and F. J. Steber, Poland.

Jefferson.—Sand and gravel and limestone were the mineral products of Jefferson County in 1954. Colwell Bros. (Watertown), Tomlinson Bros. (Antwerp), Rural Hill Sand & Gravel Co. (Ellisburg), and Angelo Vespa (Watertown) produced structural and paving sand and gravel. The Watertown quarry of the General Crushed Stone Co. and Carbola Chemical Co., Natural Bridge, yielded crushed limestone, which was utilized for highway and railroad maintenance, agricultural purposes, chemical uses, whiting, soap, and insecticides.

Kings.—F. E. Grauwiller Transportation Co., Inc., recovered sand for structural purposes.

Lewis.—Structural and paving sand and gravel were recovered from pits worked by Roy Allen & Son and Lewis County Highway Department, Lowville. The Denmark and Lowville Public Works Departments produced limestone for use as riprap.

Livingston.—Rock salt from the Retsof mine of International Salt Co., Inc., continued, in 1954, to be the most important mineral product of Livingston County. Output increased because of heavier demand for salt for ice-control purposes. Valley Sand & Gravel Corp., operating a pit at Avon, continued to be the only commercial

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producer of sand and gravel in Livingston County. Louis J. Johnston, Caledonia, again produced calcareous marl for agricultural uses.

Madison.—The principal mineral product of Madison County in 1954 was crushed limestone for road material and agricultural and other purposes. Output came from the Conley Quarry of Munnsville Limestone Corp., Munnsville and Worlock Stone Co., Inc., Sullivan. John Filose produced a small amount of miscellaneous stone for use in rock gardens, from a quarry near Chittenango.

Monroe.—Mineral products of Monroe County in 1954, in order of decreasing value of output, were sand and gravel, limestone, and gypsum. Sand and gravel for building and road construction was produced by Elam Brothers Corp., Hoadley Sand & Gravel, Newport Sand & Gravel Co., all in the Rochester area; and Brockport Ready Mix and Ingersoll Supply & Equipment Corp., both in Spencerport. The only producer of limestone—Dolomite Products Co.—worked its Penfield plant for the production of crushed and broken limestone for riprap, concrete, highway and railroad construction, and agricultural purposes. Ebsary Gypsum Co., Inc., produced both crude and calcined gypsum in Monroe County in 1954. The company mine and plant were sold to The Ruberoid Co. during the year.

Montgomery.—Sand and gravel for structural purposes was produced by St. Johnsville Supply Co., Inc., at its pit and plant in St. Johnsville. Crushed Rock Products, Inc., operated a quarry west of Pattersonville and produced crushed limestone for highway construction and maintenance.

Nassau.—The mines of Nassau County were first in the State in the production of sand and gravel. The largest of the 16 commercial operations was the Colonial Sand & Stone Co., Inc., plant and pit at North Hempstead. This company also had a pit and plant in operation at Port Washington. Other large producers in 1954 were Metropolitan Sand & Gravel Corp., Port Washington; Penn Industries, Inc., Port Jefferson; and U. S. Dredging Corp., Huntington.

Niagara.—Limestone and sand and gravel were the principal mineral products of Niagara County in 1954. The Lockport pit and fixed plant of Gasport Sand & Gravel Co., Inc., produced building and paving sand and gravel. The Gasport quarry of Colorado Fuel & Iron Corp. yielded crushed limestone for metallurgical purposes, highway maintenance and construction, and agricultural uses. Lockport Stone Co., Inc., Lockport, and Niagara Stone Corp., Niagara Falls produced crushed limestone for highway construction.

Oneida.—The Oriskany Falls and Prospect quarries of Eastern Rock Products, Inc., worked throughout the year and yielded limestone for riprap, railroad and highway construction and maintenance, and agricultural purposes. Eight commercial producers of sand and gravel were active in Oneida County in 1954. George W. Bryant Core Sands, Inc., and Whitehead Bros. Co., McConnellsville, and Eastern Rock Products, Inc., Boonville, produced molding sand. The pits and plants of Eastern Rock Products, Inc., at Barneveld and Boonville yielded building and paving sand. Other producers of sand and gravel included Frank Cittadino, Utica; Grove Grill (operating under the name of Barneveld Gravel Supply) Barneveld; Hanicker Bros. and Rome Sand, Inc., Rome; and LeRoy E. Swartout, Sr., Boonville. Clinton Metallic Paint Co. continued to produce red iron

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ore for use as a pigment in paint manufacture at its mine and mill at Clinton.

Onondaga.—The mines, pits, quarries, plants, and wells in Onondaga County yielded stone, salt, sand and gravel, cement, and clays in 1954. Allied Chemical & Dye Corp., Solvay Process Division, worked its Jamesville quarry, and Brickyard Falls Farm worked the Pompey quarry during the year. These produced crushed limestone for a number of uses, including highway and railroad construction and agricultural purposes. Allied Chemical & Dye Corp., Solvay Process Division, also operated wells at Tully and a plant at Solvay for the production of evaporated salt. The Jamesville Cement plant of Alpha Portland Cement Co. was active during 1954. Building and paving sand and gravel was produced in Onondaga County in 1954 by Steven Kravec and S. F. Clough, both of Syracuse, and General Crushed Stone Co., Manlius. Syracuse Brick Co., Cicero, and Syracuse Pottery Co., Inc., Warners, produced miscellaneous clay for brick and other heavy clay products, as well as for art pottery.

Ontario.—Mineral products of Ontario County in 1954 included sand and gravel and stone. The largest producer in the county was Ontario Sand & Gravel Co., Inc., with a pit at Phelps. Other producers of sand and gravel for road and building construction included Mackenzie Sand & Gravel, Clifton Springs; Nathan Oaks & Sons, Oaks Corners; and Phelps Sand & Gravel Corp., Phelps. General Crushed Stone Co. recovered crushed limestone for highway and railroad construction at the Geneva quarry near Oaks Corners.

Orange.—Sand and gravel and clays were the only mineral products reported from Orange County in 1954. Newburgh Sand Stone & Gravel Corp., the largest producer of sand and gravel in the county, worked its pit near Newburgh for building and paving material. Other producers were The Windsor Building Supplies Co., Inc., Newburgh; Dickinson Sand & Gravel Co., Bloomingburg; A. W. Hollenbeck, Inc., Chester; and Cornwall Rock Products Co., Inc., Newburgh. The Jova Brick Works produced miscellaneous clay at its Newburgh pit.

Orleans.—Bank-run gravel for road maintenance was produced by Arnold H. Pickett Sand & Gravel Co., Albion. Oak Orchard Sand & Gravel Co., with a pit and fixed plant near Medina, produced structural sand and gravel and gravel for miscellaneous uses.

Oswego.—Paving sand and gravel was produced by General Crushed Stone Co. at the Lacona pit near Sandy Creek. Massaro Co., Inc., Volney, continued to work in the county in 1954. Sand and gravel for structural purposes and for ready-mixed concrete was produced by Davies Sand & Gravel Co., Oswego. A pit belonging to Whitehead Bros. Co. near Pulaski continued to yield molding sand.

Otsego.—The only mineral product reported from Otsego County in 1954 was sand and gravel. The largest producer was Seward Gravel Co., with a pit at Colliersville yielding building and paving sand and gravel. Other active sand and gravel producers included Unadilla Concrete Products Co., Unadilla, and Homer F. Baker, Richfield Springs.

Putnam.—Sand and gravel and stone were the only minerals produced in Putnam County in 1954. Lloyd L. Archer operated a sand and gravel pit near Mahopac to produce molding sand and bank-

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run gravel. Crushed limestone was produced by Eastern Mineral Co., Inc., at its Patterson quarry. Output was used for agricultural purposes and as a filler in soap, fertilizer, and flooring compounds.

Rensselaer.—Mineral products of Rensselaer County, in order of decreasing value of output, were stone, clays, and sand and gravel. The Campbell Mountain Quarry of Fitzgerald Bros. Construction Co., Inc., yielded Rensselaer grit (a conglomerate), which was sold for use as concrete aggregate and roadstone. Bleau Brick Works, Inc., Troy, and Champlain Brick Co., Mechanicville, produced clay for use in manufacturing heavy clay products and high-grade tile. Sand and gravel was produced by Valente Sand & Gravel, Troy; Albert Flaxmyer, Averill Park; Sidney B. Sharpe, Rensselaer; Everett Holser, Averill Park; and C. A. Wicks, West Sand Lake.

Rockland.—Three basalt quarries were active in Rockland County in 1954. The largest was the Haverstraw quarry of New York Trap Rock Corp., Inc. Output was crushed for use in highway and railroad construction and maintenance. Other basalt producers were Suffern Stone Co., Suffern, and West Nyack Trap Rock Co., West Nyack. New York Trap Rock Corp. Tomkins Cove plant yielded crushed limestone for highway maintenance and construction.

St. Lawrence.—The Balmat and Edwards mines of St. Joseph Lead Co. operated continuously throughout the year. The Balmat mine produced silver, lead, and zinc, and the Edwards property yielded zinc only. The Benson mine of Jones & Laughlin Ore Corp. near Starlake continued to operate during 1954. Sintered concentrate was shipped to the company steel mills in the Pittsburgh, Pa., area. Building and paving sand and gravel was produced in St. Lawrence County in 1954 by Robert Bicknell, Potsdam; James Coffey, Pine Hill; George Cooke, Evans Mills; Vance Lucas, Nicholville; Kenneth J. Premo & Co., Massena; and Putnam-Hawly Building Materials, Inc., Potsdam. Crushed limestone for use in highway maintenance and construction and for agricultural purposes was produced by Balducci Crushed Stone Co., Gouverneur; Barrett Division, Allied Chemical & Dye Corp., Norwood; and McConville, Inc., Ogdensburg. Barrett Division, Allied Chemical & Dye Corp., also produced broken stone for riprap. McConville, Inc., operated its quarry and crusher only 6 months. The largest producing talc property in the State was International Talc Co. mine near Gouverneur. Crude production was ground for use in the paint and ceramics industries, building materials, soap, and floor and wall tile. The only other talc mine active in the county in 1954 was the Gouverneur Talc Co., Inc., property near Gouverneur. Balducci Crushed Stone Co., Gouverneur, produced burnt lime for agricultural uses during the year.

Saratoga.—Molding sand was the major output of the 12 active commercial sand and gravel producers in Saratoga County in 1954. Major producers were John B. Bellott & Son, Elnora; W. J. Dyer, Gansevoort; Hudson Valley Sand & Stone Co (the largest producer), Wilton; and Whitehead Bros. Co., which operated several pits in the county. The Saratoga Springs quarry of the Pallette Stone Corp. produced crushed and broken stone for riprap and highway construction.

Schenectady.—The major structural and paving sand and gravel producer was Scotia Stone & Gravel Co., Inc., with a pit and fixed

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plant at Scotia. Other producers during the year included Melvin J. Borst and Ernest B. Quay, Schenectady, and DeLuke Sand & Gravel Co., Inc., Scotia.

Schoharie.—Crushed limestone for agricultural purposes was produced at the Masick Soil Conservation Co. quarry of A. Arthur Masick. North American Cement Corp. continued to operate its Howes Cave plant in 1954. Limestone and clay for use in the manufacture of portland cement were quarried at company operations nearby.

Schuyler.—Evaporated salt was produced principally by the vacuum-pan process at the Watkins Glen operation of International Salt Co., Inc., and by the Watkins Salt Co., also of Watkins Glen. D. & T. Franzese Bros., Inc., recovered structural sand and gravel from a pit near Watkins Glen.

Seneca.—Finger Lakes Peat Moss Co. and Junius Peat Co., both near Waterloo, recovered peat in 1954.

Steuben.—Steuben County had three active sand and gravel producers in 1954. Rinehart & Son Sand & Gravel Co., the largest producer, worked a pit near Corning and produced structural sand and gravel. Other producers of structural sand and gravel in the county were the Bath and Cohocton plants of Bath Sand & Gravel Co. and Buffalo Slag Co., Inc., respectively.

Suffolk.—The only mineral product of Suffolk County in 1954 was sand and gravel. Principal producers during the year were Steers Sand & Gravel Corp., Northport; Broad Hollow Estates, Inc., Huntington; U. S. Dredging Corp., Huntington; Metropolitan Sand & Gravel Co., Smithtown; and East Coast Lumber Terminal, Inc., Farmingdale.

Sullivan.—Sand and gravel producers, in order of decreasing value, were Sullivan Highway Products Corp., Summitville; Roy Crandall, Inc., Jeffersonville; Louis Pshonick, Liberty; and Liberty Sand & Gravel Co., Inc., Swan Lake.

Tioga.—Three commercial sand and gravel producers were active in Tioga County in 1954. The principal producer was Central Materials Corp., Owego, producing building and paving sand and gravel. Other producers included Herman E. Bunce with a pit and fixed plant at Barton and A. O. Swanson, Waverly; these two operations recovered structural and paving sand and gravel.

Tompkins.—The rock-salt mine and mill of Cayuga Rock Salt Co., Inc., near Myers continued to operate during 1954. Evaporated salt was produced by the vacuum-pan process from artificial brines at the Myers plant of International Salt Co., Inc., Ludlowville. Three commercial sand and gravel producers were active in the county in 1954; the largest was Rumsey-Ithaca Corp., with a pit near Ithaca producing structural sand and gravel. Other producers included University Sand & Gravel, Brooktondale, and Mrs. Amy H. Scott, Trumansburg.

Ulster.—Minerals produced in Ulster County in 1954 included clays, natural cement, stone, sand and gravel, and abrasives. The Kingston pit of the Hutton Co. yielded clay for manufacturing heavy clay products. Other producers of miscellaneous clay in the county were Brigham Brick Corp., East Kingston; Alva S. Staples, Saugerties; and Star Brick Corp., East Kingston. Natural and special mortar cements were produced by the Rosendale plant of the Century Cement Mfg.

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Co., Inc. Paving sand and gravel and molding sand were produced by Dutchess Quarry & Supply Co., Inc., Wawarsing, and James Ricker, Kingston, respectively. Frend Bush produced millstones from a quarry near High Falls. Callanan Road Improvement Co. quarry and plant No. 3 at Kingston yielded crushed and broken limestone for road construction and riprap. Rough dimension stone and curbstone were produced at a quarry near Accord by Vincent Lawrence and by the Richard F. Dunn Estate, Jockey Hill, respectively.

Warren.—Glens Falls Portland Cement Co. operated its Glens Falls cement plant and limestone quarry in 1954. Barton Mines Corp. open-pit mine near North Creek yielded garnet for sandpaper manufacturing and glass grinding and polishing.

The Glens Falls Quarry of Jointa Lime Co., Inc., quarried limestone for highway construction and maintenance. H. Russell Harris, Glens Falls, produced structural gravel.

Washington.—Washington County was the only source of slate in New York again in 1954. The largest producer was Central Commercial Co., Hampton. Other producers included Tatko Bros. Slate Co., Inc., Hilltop Slate Co., Sheldon Slate Products Co., Inc., all near Middle Granville, and Joseph A. Ponda and Western Slate Co., Granville. Crushed limestone for highway construction and agricultural uses was produced at a quarry of the Hudson Valley Sand & Stone Co., Middle Falls. Julius H. Hunt, Fort Ann, was the largest producer of sand and gravel. Other producers included Warren Barrows, Ray Stout, and Ralph Yarter, Argyle; George Keys, Hebron; and Ray Sheehan, North Granville.

Wayne.—Three commercial sand and gravel operators were active in Wayne County in 1954. M. A. Montemorano, Clyde, was the largest producer; Gustavus Young, also of Clyde, and Eugene Dote, Wolcott, were the others.

Westchester.—Emery, stone, and sand and gravel were produced in Westchester County in 1954. Joe DeLuca, operating the DeLuca mine, and DiRubbo & Ellis Kingston mine near Peekskill and Croton, respectively, were the only producers of emery in New York in 1954. Five commercial sand and gravel plants were active. The Mount Kisco pit of Empire Sand & Stone Corp. near Bedford produced building sand and gravel. Camarco Material & Supply Co., Somers, and Davis Sand & Gravel Co., Inc., Bedford Hills, produced molding and building sand and gravel, respectively. New York Trap Rock Corp. operated the Verplanck quarry near Westchester for production of ground limestone for asphalt filler. Quintino Ciuffelelli produced granite dimension stone for construction purposes.

Wyoming.—North River quarry of American Bluestone Co., Portageville, was worked during 1954. Dressed architectural stone and rubble were produced. Evaporated salt from artificial brines was produced at the Silver Springs plant of Morton Salt Co. The city engineer of Newburgh and State of New York Department of Public Works produced paving sand and gravel in 1954.

Yates.—Sand and gravel produced by James D. McKee and Jerusalem town superintendent was the only mineral product of Yates County in 1954. The output was used as structural sand and gravel.

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The Mineral Industry of North Carolina

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, United States Department of the Interior and the Geological Survey of North Carolina.

By J. R. Thoenen[1] and Jasper L. Stuckey[2]

THE TOTAL mineral production of North Carolina in 1954 was valued at $41.7 million, an alltime high and an increase of $3.2 million or 8 percent over 1953, the previous high. Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. The Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

Commodities showing gains in value of production in 1954 over 1953 were abrasive stones, beryllium and tungsten concentrates, miscellaneous clays (mined for heavy clay products), commercial crushed granite, dimensions marble, scrap and sheet mica, commercial sand and gravel, and noncommercial[3] gravel.

Those commodities recording lower production values than in 1953 were asbestos, kaolin, vermiculite, feldspar, dimension granite, noncommercial crushed granite, crushed limestone (both commercial and noncommercial), crushed marble, miscellaneous stone (including quartz), olivine, talc and pyrophyllite, and noncommercial sand.

For the first time since 1949 gold production was reported. This came from a small tonnage of concentrate recovered from mining a gold-silver-copper-lead ore. All four metals were reported in 1954.

Credit for over one half of the total value of the State's mineral production goes to the producers of the mineral aggregates—sand, gravel, and stone.

No production of mineral fuels was reported for 1954.

Under the Defense Minerals Exploration Administration (DMEA) program, which renders Government assistance in the exploration and development of critical and strategic minerals, 61 projects were active or completed in 1954 compared with 66 in 1953. The total dollar value of expenditures was $196,380, of which the Government share was $163,739 (83 percent), as compared with $237,736 and $213,960, respectively, in 1953, a decrease of 17 percent in total and 23 percent in the Government portion.

As in 1952 and 1953, the greatest activity under DMEA was in exploration for strategic mica. During 1954, 60 projects in 9 counties

[1] Chief, Field Station, Knoxville, Tenn., Region V, Bureau of Mines.
[2] State geologist, North Carolina Geological Survey, Raleigh, N. C.
[3] Produced by Federal, State, or Municipal Governments for their own use plus that produced by contractors dealing only with Government agencies.

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TABLE 1.—Mineral production in North Carolina, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Abrasive stones	(2)	$16,150	[3] 587	[3] $12,125
Clays	1,466,232	2,534,908	1,872,541	2,519,721
Copper—pounds			360	106
Feldspar, crude—long tons	268,042	3,290,495	230,744	2,220,707
Gold—troy ounces			214	7,490
Lead			4	1,049
Mica: Scrap and flake	56,834	1,428,793	61,049	1,457,122
Sheet—pounds	619,895	1,308,494	479,221	1,787,197
Sand and gravel	6,910,982	4,992,991	7,441,200	5,508,284
Silver—troy ounces			[4] 438	[4] 396
Stone	[5] 9,317,390	[5] 14,424,323	10,133,728	15,625,331
Talc and pyrophyllite, crude	119,341	578,239	112,704	388,428
Tungsten, concentrate 60 percent WO_3 basis	2,074	([6])	2,538	([6])
Undistributed: Asbestos, beryllium concentrate, columbium-tantalum concentrate, lithium minerals, manganiferous ore, millstones (1954), olivine, quartz, stone (crushed and dimension marble, 1953), tungsten concentrate, vermiculite, and minerals whose value must be concealed for particular years indicated by footnote reference [6] in appropriate column		[7] 9,876,773		12,122,942
Total North Carolina		[7] 38,451,000		41,651,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Weight not recorded.
[3] Grinding pebbles and tube-mill liners only.
[4] Final figure. Supersedes preliminary figure given in commodity chapter.
[5] Excludes certain stone, value for which is included with "Undistributed."
[6] Value included with "Undistributed."
[7] Revised figure.

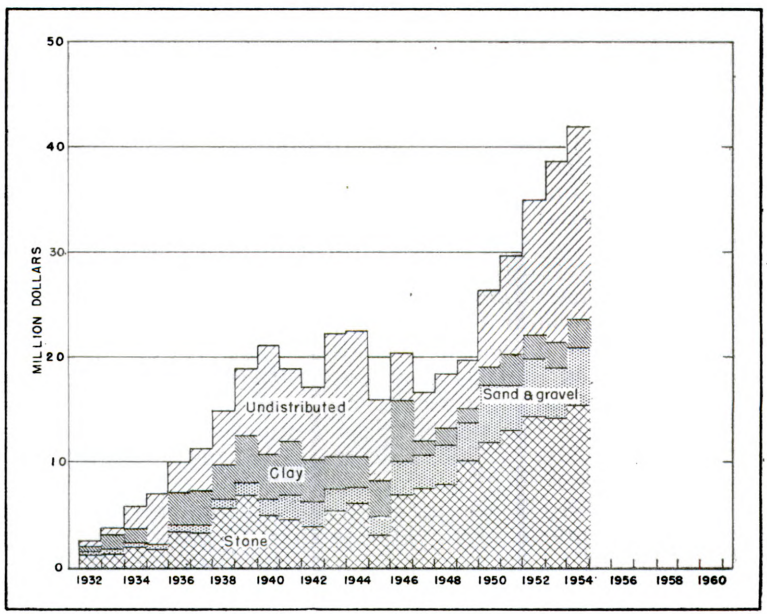

FIGURE 1.—Value of mineral production in North Carolina, 1932–54.

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were for mica and 1 in 1 county for beryl-tantalite-tin. Of the 61 projects in 1954, 27 were continuations from 1953, and 34 were new in 1954.

More details with respect to this program are discussed under the county section of this chapter.

TABLE 2.—Average unit values of mineral commodities in North Carolina, 1950–54 [1]

Commodity		1950	1951	1952	1953	1954
Asbestos	short ton	$100.00	$100.00	--	[2] $21.10	[2] $17.10
Beryl	do	--	300.00	--	400.00	502.50
Clay:						
Kaolin	do	20.82	21.35	$20.80	18.87	18.80
Miscellaneous	do	.90	1.18	1.16	1.16	1.15
Coal	do	--	--	7.93	--	--
Columbite-tantalite, 70 percent concentrate	pound	--	--	3.20	--	--
Feldspar	long ton	6.05	7.40	10.05	12.28	9.62
Ilmenite, concentrate (51 percent TiO_2)	pound	(3)	(3)	(3)	--	--
Manganiferous iron ore (10–35 percent Mn)	long ton	--	--	--	20.00	--
Mica:						
Scrap and flake	short ton	26.59	27.44	26.48	25.14	23.87
Sheet	pound	.21	.27	1.12	2.11	3.73
Olivine, crude	short ton	(3)	(3)	(3)	(3)	(3)
Quartz	do	4.17	4.47	4.61	5.70	4.27
Gravel	do	.99	.95	1.11	1.16	1.10
Grinding pebbles	do	17.00	17.80	18.00	17.60	20.25
Sand	do	.41	.34	.38	.47	.47
Spodumene	do	--	55.00	55.00	--	--
Stone:						
Granite:						
Crushed	do	1.46	1.43	1.44	1.42	1.41
Dimension	do	48.71	55.85	54.45	33.90	41.13
Limestone, crushed	do	1.32	1.35	1.35	1.39	1.39
Marble:						
Crushed	do	--	2.70	5.34	5.60	6.75
Dimension	do	119.00	118.00	117.50	117.70	117.62
Miscellaneous, crushed	do	1.17	1.02	1.08	1.21	1.25
Sandstone:						
Crushed	do	.59	--	--	--	--
Dimension	do	--	--	2.40	--	--
Traprock, crushed	do	1.65	1.26	1.29	--	1.46
Talc and pyrophyllite	do	[4] 15.87	[4] 17.40	[4] 15.34	[2] 4.85	[2] 3.44
Tube-mill liners	do	15.20	17.90	21.75	17.95	22.00
Tungsten, concentrate	do	(3)	(3)	(3)	(3)	(3)
Vermiculite	do	18.20	12.68	8.93	8.93	8.92

[1] For greater detail on prices by grade and market, see vol. I, Minerals Yearbook, 1954.
[2] Value of crude ore at mine.
[3] Bureau of Mines not at liberty to publish.
[4] Average value of products sold or used.

REVIEW BY MINERAL COMMODITIES

METALS

Beryllium Concentrate.—Resumption of the production of beryllium concentrate in 1953 was followed in 1954 by a 127-percent increase in tonnage and a 187-percent rise in total value. This represents a 25-percent increase in reported unit value.

Federal Geological Survey Circular 309 reports the latest estimates of beryl reserves in the spodumene belt of North Carolina as 823,000 tons. This is nearly three times the previous estimates.

Gold, Silver, Copper, and Lead.—The H. & H. Mining Co. of Enfield reported mining 175 tons of ore from which were recovered 214 ounces of gold valued at $7,500; 438 ounces of silver valued at $396; 360 pounds of copper valued at $106; and 4 tons of lead valued at $1,049.

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Titanium.—Former 1953 operations in Caldwell County remained closed, and no new operations were reported.

Tungsten Concentrate.—The Hamme mine in Vance County, operated by the Tungsten Mining Corp., produced 3,028 tons of concentrate, (2,538 tons on a 60-percent WO_3 basis)—an increase of 22-percent in tonnage and 21 percent in total value over 1953. Mine-run ore production was increased 27 percent thereby confirming the company estimate that 1954 production would equal or exceed 275,000 tons.[4] The company claimed the distinction of the first commercial use of infrared light for drying concentrate. Two driers were so equipped, one handling jig concentrate and the other table flotation product. Each had 0.3-t. p. h. capacity, and each was equipped with 70 GE 375-W infrared bulbs. Power consumption was reported as 87.5 kw. a ton.

TABLE 3.—Tungsten concentrate produced and shipped, 1945–49 (average) and 1950–54

Year	Produced		Shipped from mines	
	Short tons, 60 percent WO_3	Units	Short tons, 60 percent WO_3	Units
1945–49 (average)	580	34,777	542	32,557
1950	1,088	65,271	1,240	74,393
1951	1,035	62,078	1,041	62,463
1952	1,248	74,904	1,254	75,226
1953	2,525	128,645	2,074	124,465
1954	3,028	151,166	2,538	152,296

NONMETALS

Abrasives.—Grinding pebbles, millstones, and tube-mill liners are classified as abrasive stones. All were mined in Rowan County, and the total value of 1954 production registered an increase over 1953.

Asbestos.—Asbestos production in 1954 was credited to the same 2 producers in Transylvania and Yancey Counties as in 1953 but at a reduction of 40 percent in tonnage and 52 percent in total value.

Clays.—Total production, for sale or use, of miscellaneous clays and kaolin reached an alltime high for the State at 1.9 million short tons valued at $2.5 million. This was a 28-percent increase in tonnage but actually a slight decrease below the total value for 1953. The reason for this imbalance between tonnage and value was a 30-percent advance in the tonnage mined of miscellaneous clays for heavy clay products and a slump of 56 percent in the production of the higher valued kaolin clays.

The year showed marked progress by a number of manufacturers of heavy clay products in enlargement and modernization of their plants.

United States Department of Commerce released (1954) figures in Facts for Industry showing production of 1½ billion brick in the South Atlantic States (1953), or 23 percent of the National total. North Carolina was credited with one-third of the Southeastern States, total.[5]

[4] Mining Engineering, Tungsten-Mining Corporation Expands Mill: Vol. 6, February 1954, p. 135.
[5] Brick and Clay Record, August 1954, p. 28.

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No production of kaolin was reported in 1954 from 2 of the 5 plants reporting in 1953; however, a new producer reported a small tonnage of halloysite. Clays were mined from 36 deposits by 30 companies for their own manufacture into heavy clay products.

TABLE 4.—Clays sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	978,974	$1,209,719	1952	1,357,700	$2,080,172
1950	1,437,202	1,766,785	1953	1,466,232	2,534,908
1951	1,462,030	2,177,515	1954	1,872,541	2,519,721

Feldspar.—Feldspar production dropped nearly 40,000 tons and over a million dollars in value below the peak year of 1953, a loss of 14 percent in tonnage and 33 percent in value from 1953.

TABLE 5.—Crude feldspar sold or used by producers, 1945–49 (average) and 1950–54

Year	Long tons	Value	Year	Long tons	Value
1954–49 (average)	192,509	$1,047,230	1952	240,364	$2,416,031
1950	183,027	1,107,061	1953	268,042	3,290,495
1951	166,361	1,230,404	1954	230,744	2,220,707

Mica.—Scrap- and flake-mica production increased 4,200 tons or 7 percent above 1953, but the total value gained $28,300, or only 2 percent. This represents a drop of $1.27 a ton or 5 percent.

Sheet-mica production was 23 percent less than in 1953, but total value rocketed to a new high of $1.8 million—37 percent above 1953 and 1 percent above the previous alltime high of 1943. A comparison of unit values for 1953 and 1954 is interesting. In 1953 the average value a pound as reported was $2.11, whereas in 1954 it was $3.73. This indicates the material as received at the buying centers was better prepared and higher grade in 1954.

Olivine.—C. P. Wiseman (Wray mine) successor to Carolina Pyrophyllite Co. and the Harbison-Walker Refractory Co. (Addie mine) continued to produce olivine. Production dropped 14 percent in tonnage and 6 percent in value from 1953.

Quartz.—Quartz, as in past years, was a mill byproduct from the processing of crude feldspar. There were 2 producers: The Feldspar Flotation Co. and the International Minerals Corp., each with 2 plants in Mitchell County. Production in 1954 increased 26 percent in tonnage but decreased 5 percent in total value compared with 1953. In 1954 quartz has been included with stone as "miscellaneous stone."

Sand and Gravel.—The value of sand and gravel production increased 10 percent; from $5 million in 1953 to $5.5 million in 1954, but tonnage produced increased only 8 percent from 6.9 to 7.4 million short tons. Production of commercial sand and gravel remained at 60 percent of total production and gained 8 percent in tonnage and 14 percent in value above 1953. Noncommercial sand and gravel gained 7 percent in tonnage but less than 1 percent in value above 1953.

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TABLE 6.—Mica sold or used by producers, 1950–54

Kind	1950		1951		1952		1953		1954	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Sheet mica:										
Uncut punch and circle.....pounds..	457, 428	$71, 323	419, 524	$84, 056	548, 723	$102, 928	518, 917	$74, 782	339, 980	$39, 070
Larger uncut mica.....do....	26, 308	30, 856	45, 425	43, 148	10, 660	17, 362	4, 540	6, 371	8, 311	10, 859
Half trim purchased by GSA.....do....					677	2, 763	1, 409	3, 355	(1)	(1)
Full trim purchased by GSA.....do....					35, 271	541, 022	95, 029	1, 233, 986	130, 930	1, 737, 268
Total sheet mica.....do....	483, 736	102, 179	464, 949	127, 204	595, 331	664, 075	619, 895	1, 308, 494	479, 221	1, 787, 197
Scrap mica:										
Total scrap and flake mica.....short tons..	48, 193	1, 281, 584	52, 550	1, 441, 886	58, 576	1, 551, 071	56, 834	1, 428, 793	61, 049	1, 457, 122
Grand total (sheet and scrap).....do....	48, 435	1, 383, 763	52, 782	1, 569, 090	58, 874	2, 215, 146	57, 144	2, 737, 287	61, 289	3, 244, 319

[1] Combined with full trim to avoid exposure of individual company data.

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Total sand production (commercial and noncommercial) comprised 57 percent of total sand and gravel production but was 3 percent below 1953 in tonnage and value. The total gravel recorded gains of 25 percent in tonnage and 20 percent in value above 1953.

The sale or use of commercial sand increased 9 percent in tonnage and 10 percent in value above 1953. The production of commercial gravel increased 8 percent in tonnage and 15 percent in value, representing an increase of 8 cents in average unit value.

The production of noncommercial sand, on the other hand, decreased 12 percent in tonnage and 23 percent in value below the previous year, and noncommercial gravel spurted to a 129-percent increase in tonnage but only 53-percent increase in value.

The production of building sand totaled 1.5 million short tons valued at $951,000, an increase of 25 percent in tonnage and 23 percent in value above 1953.

Building gravel was reported at 463,000 short tons valued at $696,000, representing a loss of 33 percent in tonnage and 31 percent in value.

No noncommercial building sand was reported, and only a small tonnage of noncommercial building gravel.

Production of noncommercial paving sand was reported as 2.1 million short tons valued at $638,000 or 30 cents a ton. Commercial paving-sand production was 455,000 short tons valued at $276,000 or 61 cents a ton.

Noncommercial paving-gravel production was reported as totaling 822,000 short tons valued at $565,000 or 69 cents a ton, while commercial paving-gravel production was recorded as 1.7 million short tons valued at $2 million or $1.20 a ton.

During the year 107,000 man-days or 980,000 man-hours was worked in producing 7.4 million tons of sand and gravel. Each man-day represented 70 tons and each man-hour 7.6; that is, 0.13 man-hour was used to produce 1 ton of sand and gravel.

Roughly 88 percent of the total output of commercial sand and gravel, or 3.95 million tons valued at $4 million ($1.01 a ton), was washed before marketing. The sand and gravel marketed without washing amounted to 531,000 tons valued at $205,000 or 39 cents a ton. Average values per ton for other sand and gravel categories were:

Commercial sand	$0.63	All gravel	$1.10
Noncommercial sand	.30	Commercial sand and gravel	.96
All sand	.47	Noncommercial sand and gravel	.41
Commercial gravel	1.25	All sand and gravel	.74
Noncommercial gravel	.69		

Stone.—Stone ranked first among mineral commodities in value of production, with a total of 10 million short tons valued at $15.6 million. This represents an increase of approximately 9 percent in tonnage and 8 percent in value above 1953.

The total production of granite of all types increased in tonnage and value in 1954 over 1953. Commercial crushed granite gained 16 percent in tonnage and 14 percent in value. Producers of noncommercial crushed granite reported 29 percent less tonnage at 26 percent less total value.

Approximately the same tonnage of marble, both crushed and dimension, was produced, as in 1953, but the combined value was up 9 per-

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TABLE 7.—Sand and gravel sold or used by producers, 1951–54, by uses

Use	1951		1952		1953		1954	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Sand (commercial):								
Building	534,898	$360,241	580,500	$364,253	1,187,343	$776,605	1,478,833	$951,481
Paving	334,393	173,967	1,134,150	620,269	618,619	320,865	455,292	276,341
Engine	22,113	22,113	22,113	22,113	59,451	53,760		
All other	41,554	62,456	44,494	48,225	94,443	68,410	196,347	116,957
Total commercial	932,958	618,777	1,781,257	1,054,860	1,959,856	1,219,640	2,130,472	1,344,779
Total noncommercial	3,695,780	932,137	3,743,907	1,047,727	2,406,774	835,434	2,118,146	641,888
Total sand	4,628,738	1,550,914	5,525,164	2,102,587	4,366,630	2,055,074	4,248,618	1,986,667
Gravel (commercial):								
Building	346,125	485,262	(1)	(1)	687,513	1,014,282	462,837	695,868
Paving	1,948,163	1,678,178	2,621,160	2,970,319	1,212,271	1,311,639	1,675,862	2,015,151
All other	151,209	136,789	(1)	(1)	279,444	233,569	216,018	230,632
Total commercial	2,445,497	2,300,229	2,743,467	3,111,898	2,179,228	2,559,490	2,354,717	2,941,651
Total noncommercial	582,135	584,559	456,117	443,684	365,124	378,427	837,865	579,966
Total gravel	3,027,632	2,884,788	3,199,584	3,555,582	2,544,352	2,937,917	3,192,582	3,521,617
Total commercial sand and gravel	3,378,455	2,919,006	4,524,724	4,173,758	4,139,084	3,779,130	4,485,189	4,286,430
Total noncommercial sand and gravel	4,277,915	1,516,696	4,200,024	1,491,411	2,771,898	1,213,861	2,956,011	1,221,854
Grand total sand and gravel	7,656,370	4,435,702	8,724,748	5,665,169	6,910,982	4,992,991	7,441,200	5,508,284

[1] Bureau of Mines not at liberty to publish; included in total.

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TABLE 8.—Stone sold or used by producers, 1950–54

	1950		1951		1952		1953		1954	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Commercial:										
Basalt, crushed					40,000	$50,000			854,000	$1,249,000
Granite, crushed	3,908,760	$5,967,268	4,669,493	$6,780,408	4,835,132	7,272,919	5,430,467	$7,833,869	6,275,889	8,908,919
Granite, dimension	23,880	1,163,098	23,458	1,309,981	24,190	1,317,249	40,825	1,403,666	(1)	(1)
Limestone, crushed	1,976,340	2,629,911	2,080,586	2,829,244	2,534,446	3,446,841	2,252,409	3,150,588	1,735,098	2,432,282
Marble	(2)	(2)	[3] 475	[3] 1,282	(2)	(2)	(2)	(2)	(1)	(1)
Stone, miscellaneous					181,119	249,992			[5] 464,462	[5] 1,945,016
Total [4]	5,908,980	9,760,277	6,774,012	10,920,915	7,614,887	12,337,001	7,723,701	12,388,123	9,329,449	14,535,217
Noncommercial:										
Basalt, crushed	97,560	160,802	75,164	94,648	72,697	95,684				
Granite, crushed	1,077,560	1,328,258	1,331,439	1,823,150	1,378,302	1,676,850	1,007,949	1,331,936	714,284	988,119
Limestone, crushed	115,590	125,625	101,424	117,310	119,836	137,068	105,089	122,628	89,995	101,995
Sandstone	(2)	(2)			2,500	6,000				
Stone, miscellaneous	511,891	519,783	330,928	336,667	459,291	442,095	480,084	581,636		
Total	1,802,601	2,134,468	1,838,955	2,371,775	2,032,626	2,357,697	1,593,122	2,036,200	804,279	1,090,114
Grand total [4]	7,711,581	11,894,745	8,612,967	13,292,690	9,647,513	14,694,698	9,316,823	14,424,323	10,133,728	15,625,331

[1] Combined with miscellaneous stone.
[2] Bureau of Mines not at liberty to publish.
[3] Excludes dimension marble 1951.
[4] Excludes dimension marble, 1950–53, and crushed marble, 1952–53.
[5] Includes quartz.

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TABLE 9.—Stone sold or used by producers, 1950–54, by kinds

Kind	1950		1951		1952		1953		1954	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Basalt, crushed	97,560	$160,802	75,164	$94,648	112,697	$145,684			854,000	$1,249,000
Granite, dimension	23,880	1,163,098	23,458	1,309,981	24,190	1,317,249	41,392	$1,403,666	(1)	(1)
Granite, crushed	4,986,320	7,295,526	6,000,932	8,603,558	6,213,434	8,949,769	6,438,416	9,165,805	6,990,173	9,897,038
Limestone, crushed	2,091,930	2,755,536	2,182,010	2,946,554	2,654,282	3,583,909	2,357,498	3,273,216	1,825,093	2,534,277
Marble, dimension	(1)	(1)	(2)	(2)	(2)	(2)	(2)	(2)	(1)	(1)
Marble, crushed			475	1,282	(2)	(2)	(2)	(2)	(1)	(1)
Miscellaneous, crushed	343,160	401,873	330,928	336,667	640,410	692,087	480,084	581,636	[3] 435,019	[3] 679,609
Sand stone, crushed	(1)	(1)			2,500	6,000				
Undistributed	168,730	117,910							29,443	1,265,407
Total	7,711,580	11,894,745	[4] 8,612,967	[4] 13,292,690	[4] 9,647,513	[4] 14,694,698	[4] 9,317,390	[4] 14,424,323	10,133,728	15,625,331

[1] Included with "Undistributed" to avoid disclosing individual company information.
[2] Bureau of Mines not at liberty to publish.
[3] Includes quartz.
[4] Exclusive of marble, 1951–53, with an incomplete total shown.

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cent due to a small increase in the higher valued dimension marble and a decrease in crushed material.

Crushed-limestone production, including commercial and noncommercial, dropped 23 percent in tonnage and value. Noncommercial crushed limestone dropped 14 percent in tonnage and 17 percent in value, and commercial crushed limestone lost 23 percent in both tonnage and value.

Talc and Pyrophyllite.—The reported production of crude talc and pyrophyllite in 1954 was 6 percent below that of 1953, and the value was 33 percent less. Talc production was up 25 percent over 1953 and increased 26 percent in total value. Pyrophyllite, on the other hand, was 7 percent lower in tonnage and 46 percent in total value.

TABLE 10.—Talc and pyrophyllite production, 1945–49 (average) and 1950–54

Year	Short tons		Value [1]	Year	Short tons		Value [1]
	Crude mined	Products sold [1]			Crude mined	Products sold [1]	
1945–49 (average)	----------	90,766	$1,129,191	1952	116,722	115,481	$1,771,518
1950	115,783	116,895	1,855,163	1953	119,341	----------	578,239
1951	115,480	113,950	1,982,927	1954	112,704	----------	388,428

[1] Value before 1953 is for products sold; value for 1953–54 is for crude ore as mined.

Vermiculite.—Vermiculite production was slightly below that of 1953.

REVIEW BY COUNTIES

Alamance.—The North State Pyrophyllite Co. Inc., continued to produce pyrophyllite from its Snow Camp mine but at a somewhat reduced rate. The Hanford Brick Co. mined clays for brick but at a lower rate than in 1953. The North Carolina State Highway and Public Works Commission mined 13,000 tons of paving sand.

Alexander.—O. C. Barnes mined a small quantity of beryl, and the North Carolina State Highway and Public Works Commission mined 623 tons of paving sand. Devier & Starrett mined a small quantity of sheet mica from the Jennings and Gwaltney mines.

Anson.—There was no production of silica (quartz) reported from Anson County in 1954 although there had been in 1953.

W. R. Bonsal Co., B. V. Hedrick Gravel & Sand Co., and the North Carolina State Highway and Public Works Commission mined sand and gravel at a rate slightly below 1953.

Ashe.—The Feldspar Producing Co., Erwin, Tenn., mined a small tonnage of feldspar from the Phillips mine.

Six operators mined sheet mica in 1954 as compared with 2 in 1953; there were 2 producers of scrap mica. The value of mica produced in 1954 was eight times that reported in 1953. Producers were Carl Hardin, West Jefferson (New Hardin mine); D. T. Brown, Zionville (Sutherland mine); Duncan Mica Co., Spruce Pine (Duncan and Hardin mines); A. M. Snipes, West Jefferson (Perkins mine); Lewie Aldridge, Spruce Pine (Jackson mine); and Vaughn Pitman, Marion (Pitman mine). In addition, a small quantity of sheet mica was

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TABLE 11.—Value of mineral production in North Carolina, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value
Alamance	(2)	(2)	Pyrophyllite, clays, sand and gravel.
Alexander [3]	$19,560	(2)	Mica, sand, beryl.
Anson	(2)	(2)	Sand and gravel.
Ashe	(2)	(2)	Mica, sand and gravel, feldspar.
Avery	(2)	$497,085	Kaolin, mica, sand.
Beaufort	(2)	(2)	Clays, sand and gravel.
Bertie	7,500	600	Sand.
Bladen	5,160	3,610	Do.
Brunswick	382	1,350	Do.
Buncombe	(2)	814,355	Sand and gravel, mica, feldspar, beryl.
Burke	3,840	2,707	Sand, mica.
Cabarrus	1,250	255,048	Stone, sand and gravel.
Caldwell	(2)	12,785	Mica, sand and gravel, clays.
Camden	7,500	6,000	Sand.
Carteret	600	1,500	Do.
Caswell	(2)	606,996	Stone, sand and gravel.
Catawba	(2)	7,915	Mica, sand and gravel, beryl.
Chatham	(2)	325,022	Clay, stone.
Cherokee	(2)	(2)	Talc, stone, mica.
Chowan	36,000	33,000	Sand.
Clay	(2)	43,125	Mica, sand and gravel.
Cleveland	2,077,594	1,802,989	Stone, mica, clays, sand and gravel.
Columbus	(2)	5,240	Sand.
Craven	8,000	4,500	Do.
Cumberland	(2)	(2)	Clays, sand and gravel.
Currituck	600	9,000	Sand.
Dare	25,800	3,000	Do.
Davidson	126,520	460,113	Stone, sand and gravel, clays.
Davie	(2)	(2)	Sand and gravel.
Duplin	(2)	870	Do.
Durham	441,985	414,151	Stone, clays.
Edgecombe	7,250	----------	Sand.
Forsyth	(2)	879,993	Stone, sand and gravel.
Franklin	3,900	2,250	Sand.
Gaston	(2)	(2)	Clay, mica, beryl.
Gates	3,000	10,500	Sand.
Graham	(2)	101,875	Sand and gravel, stone.
Granville	1,080	2,592	Sand.
Greene	25,000	18,000	Do.
Guilford	1,337,711	1,885,852	Stone, clays, pyrophyllite, sand and gravel.
Halifax	5,425	9,043	Gold, silver, copper, lead.
Harnett	(2)	(2)	Clays, sand and gravel.
Haywood	(2)	255,869	Sand and gravel, stone.
Henderson	284,856	264,603	Stone, clays, mica.
Hertford	15,000	7,500	Sand.
Hoke	(2)	232,841	Sand and gravel.
Hyde	3,000	300	Sand.
Iredell	(2)	(2)	Clays, sand and gravel, mica.
Jackson	(2)	306,735	Olivine, sand and gravel, mica.
Johnston	36,200	32,500	Sand.
Jones	1,200	(2)	Sand and gravel.
Lee	378,800	418,744	Clays, sand.
Lenoir	110,536	(2)	Sand and gravel.
Lincoln	41,060	(2)	Mica, sand and gravel.
Macon	349,208	446,833	Do.
Madison	5,800	(2)	Feldspar.
Martin	9,000	900	Sand.
McDowell	(2)	(2)	Sand and gravel, stone, mica.
Mecklenburg	(2)	11,748	Stone.
Mitchell	4,400,385	3,790,631	Mica, feldspar, quartz, kaolin, beryl.
Montgomery	(2)	(2)	Clays, sand and gravel.
Moore	(2)	(2)	Pyrophyllite, sand and gravel.
Nash	(2)	22,643	Clays, sand.
New Hanover	37,603	(2)	Sand and gravel.
Northampton	(2)	(2)	Sand and gravel, clays.
Onslow	1,018,829	518,630	Stone, sand and gravel.
Orange	8,100	4,550	Stone (1953), sand and gravel (1954).
Pamlico	15,000	4,000	Sand.
Pasquotank	5,100	7,500	Do.
Pender	222	650	Do.
Perquimans	10,500	10,200	Do.
Person	2,160	6,600	Do.
Pitt	20,000	14,880	Do.
Polk	7,938	37,750	Sand and gravel, stone.
Randolph	288,161	(2)	Pyrophyllite, stone, sand and gravel.
Richmond	41,200	369	Sand.
Robeson	35,742	8,793	Do.
Rockingham	(2)	(2)	Clays, mica.
Rowan	1,339,375	1,412,291	Stone, clays, abrasives, sand and gravel.
Rutherford	(2)	(2)	Clays, mica.
Sampson	(2)	47,954	Clays, sand and gravel.

See footnotes at end of table.

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TABLE 11.—Value of mineral production in North Carolina, 1953–54, by counties[1]—Continued

County	1953	1954	Minerals produced in 1954 in order of value
Scotland		$351	Sand.
Stanly	(2)	243,236	Clays.
Stokes	(2)	(2)	Sand and gravel, clays.
Surry	(2)	1,611,706	Stone, sand and gravel.
Swain	(2)	351,777	Stone, sand and gravel, feldspar.
Transylvania	(2)	(2)	Stone, mica.
Tyrrell	$4,800	300	Sand.
Union	(2)	839,260	Stone, clays.
Vance	(2)	(2)	Tungsten, stone.
Wake	(2)	(2)	Stone, sand and gravel.
Warren	1,800		Sand.
Washington	5,400	5,700	Do.
Watauga	(2)	(2)	Sand and gravel, mica, feldspar.
Wayne	(2)	(2)	Sand and gravel.
Wilkes	(2)	(2)	Mica.
Wilson	(2)	(2)	Stone, sand and gravel.
Yadkin	(2)	(2)	Stone.
Yancey	946,419	756,550	Mica, feldspar, asbestos, olivine, vermiculite, beryl.
Undistributed	24,881,949	21,754,940	
Total	38,451,000	41,651,000	

[1] Alleghany County not listed because no production was reported.
[2] Value included with "Undistributed."
[3] Excludes beryl and scrap mica included in other counties.

reported as coming from Ashe County but without information as to the producer.

The North Carolina State Highway and Public Works Commission reported the production of 6,900 tons of paving sand and gravel.

Avery.—Mineral production from Avery County in 1954 totaled slightly below $500,000.

The Harris Clay Co., Spruce Pine, mined roughly 15 percent less kaolin from the Gusher Knob and Kaolin mines than in 1953.

Production of either or both sheet and scrap mica was reported from 48 operations during 1954. The total county production of sheet was 53,000 pounds valued at $200,000 compared with 13,600 pounds valued at $138,000 in 1953. This represents nearly a 300-percent increase in quantity but only a 45-percent increase in total value.

A small tonnage of scrap mica was marketed as a byproduct from sheet-mica production.

Producers reporting 500 pounds or over of sheet mica were: Cow Camp Mining Co. (Cow Camp mine); Waites Avery (Meadow mine); Jessie Johnson (Joe Davis rock mine), Robert Guy, Newland (Benfield mine); Elk Mica Miners, Newland (Elk mine); Dellinger Bros., Newland (Charlie Ridge mine); and B. A. Vance, Spruce Pine (Lincoln Rock mine). In addition roughly 800 pounds was reported from the county without information as to the producer.

DMEA activities in the county are shown in table 12.

Beaufort.—The Eastern Brick & Tile Co. continued mining clays for its own use in the manufacture of brick and tile.

The North Carolina State Highway and Public Works Commission mined 56,250 tons of paving sand, about the same rate as in 1953.

Bertie.—The North Carolina State Highway and Public Works Commission mined 2,000 tons of paving sand compared with 25,000 tons in 1953.

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TABLE 12.—DMEA mica projects in Avery County, 1954

Contractor	Property	Contract		
		Date	Total amount	Government participation, percent
Elk Mica Miners	Elk mine	Sept. 30, 1952	$6,900	90
Fred Taylor et al	Cow Camp mine	June 15, 1953	5,450	90
Joe C. Vance	Doublehead	Jan. 25, 1954	6,475	75
Vance & Odom	Gardner prospect	Mar. 12, 1954	6,265	75
J. R. Beam & H. Boone	Ingram prospect	June 7, 1954	1,816	75
Smith, Stuart & Dugger	Ingram-Benfield	July 12, 1954	4,413	75
Joe C. Vance	Joe mine	Sept. 9, 1954	3,613	75
Pancake Miners	Pancake mine	Oct. 7, 1954	4,940	75

Bladen.—The North Carolina State Highway and Public Works Commission mined 36,100 tons of paving sand compared with 52,000 tons in 1953.

Brunswick.—The North Carolina State Highway and Public Works Commission mined 18,200 tons of paving sand compared with 7,600 tons in 1953.

Buncombe.—Mineral production from Buncombe County reached a total value of $814,000 in 1954.

Minerals mined were beryl, feldspar, sand and gravel, and mica. Orville C. Hewitt, Asheville (Beryl mine), mined and marketed a small quantity of beryl, and H. D. Trantham, Asheville (Wadkins mine), and the Feldspar Milling Co., Burnsville, reported the production of potash and soda feldspar, respectively. Both Feldspar Milling Co. and International Mining & Chemical Corp. (Consolidated Feldspar Division) reported the preparation of ground feldspar.

Commercial sand and gravel was mined and marketed by Bell Sand Co., McCrary Construction Service Co., Reed & Albee, Asheville Sand Co., and Frank Austin, all of Asheville, and Grove Stone & Sand Co., of Swannanoa. Total county production was appreciably above 1953 in tonnage and value; however, the average value dropped 6 cents a ton.

Sheet-mica production increased sevenfold over 1953, and active producers increased from 3 to 8, with some additional production reported without identification of the source. The three producers of 1953—D. M. Burgess, George Burnett, and H. D. Trantham—continued production in 1954; in addition, Paul Meeker (Bryson No. 2 mine), Fred Wilson (Bolin mine), Ed. McNeil (Swannanoa mine), E. D. Buchanan (Burleson mine), and G. H. Williams (Brushy Mountain mine) reported production.

TABLE 13.—Sand and gravel sold or used by producers in Buncombe County, 1949–54

Year	Short tons	Value	Year	Short tons	Value
1949	523,260	$527,025	1952	852,177	$821,931
1950	564,860	536,555	1953	456,465	494,172
1951	798,454	631,839	1954	(1)	(1)

[1] Bureau of Mines not at liberty to publish.

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A small tonnage of scrap mica was also reported.

The total county mica production in 1954 was valued at $22,000 compared with $3,000 in 1953.

Burke.—The North Carolina State Highway and Public Works Commission reported the mining of 3,000 tons of paving sand.

Cabarrus.—The North Carolina State Highway and Public Works Commission reported production of 8,100 tons of paving sand.

Lee White gravel pit reported production of 26,400 tons of paving gravel valued at $28,500. No commercial gravel was reported in 1953.

The Superior Stone Co. quarried 193,000 short tons of crushed basalt valued at $225,000 for concrete aggregate and road metal.

Caldwell.—The Moore Brick Co. continued to produce miscellaneous clays for use in the manufacture of heavy clay products.

The North Carolina State Highway and Public Works Commission reported production of 4,000 tons of structural sand and 1,600 tons of structural gravel.

Five producers of sheet mica were Bowman Bros. (Bowlin-Adams and Bowman mines), R. L. Auton (Earl Bradford Bryant and McGee mines), J. D. Pritchard (Johnson mine), Albert Hamby (Hill Carter mine), and Will L. Clark (Moretz mine).

Camden.—The North Carolina State Highway and Public Works Commission reported production of 20,000 tons of paving sand.

Carteret.—The North Carolina State Highway and Public Works Commission reported production of 7,500 tons of paving sand.

Caswell.—The North Carolina State Highway and Public Works Commission reported production of 13,000 tons of paving sand.

Lambert Bros. quarried 400,000 tons of crushed granite valued at $600,000 for concrete aggregate and road metal.

Catawba.—Earl Bowman mined and marketed a small quantity of beryl from the Beryl mine. The North Carolina State Highway and Public Works Commission reported production of 10,300 tons of paving sand.

Production of sheet and/or scrap mica was reported by four operators, none of which were recorded as producing in 1953. The two producers of record in 1953 did not report in 1954.

Producers in 1954 were E. B. Sigman (Sigman mine), Donald H. Duncan (Abernathy mine), Alvin E. Pyatte (Rock Hole mine), C. F. Speagle (Speagle mine), also a small quantity coming from unidentified sources.

The Hefner Mining Co. (Hefner prospect), in cooperation with DMEA, explored for mica.

Chatham.—The total mineral production of Chatham County amounted to $325,000 in 1954 and consisted of 255,000 short tons of miscellaneous clays valued at $279,000 mined by the Pomona Terra-Cotta Co. (Greensboro), Chatham Brick & Tile Co. (Gulf), Boren Clay Products Co. (Pleasant Garden), and the Cherokee Brick Co. (Raleigh) and 62,000 short tons of shale valued at $46,000 produced for concrete aggregate and road metal by the North Carolina State Highway and Public Works Commission.

Cherokee.—Talc production increased from 7,000 short tons valued at $501,000 in 1953 to 9,000 short tons valued at $132,000 in 1954. Producers were the Hitchcock Corp. (Nancy Jordan and Carolina

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mines) and the Minerals & Metals, Inc. The Maurey Mining Co. reported a small tonnage in 1953 but none in 1954.

The Columbia Marble Co. reported a 10-percent increase in tonnage and value for dimension marble but a 25-percent decline in tonnage and 10-percent decline in value for crushed marble for terrazzo and agricultural markets.

Production of 74 pounds of sheet mica valued at $761 was reported from unidentified producers.

Chowan.—The North Carolina State Highway and Public Works Commission reported the production of 110,000 tons of paving sand.

Clay.—The North Carolina State Highway and Public Works Commission reported the production of 41,500 tons of paving gravel.

The Western Mica Co. produced scrap mica from its Cohoma pegmatite mine.

Cleveland.—The total mineral production from Cleveland County was valued at $1.8 million, a drop of 13 percent from 1953.

The Bennett Brick & Tile Co. mined 19,000 tons of clay for use in the manufacture of heavy-clay products.

The company announced plans to double its capacity by installing a new tunnel kiln 280 feet long on the site of the old kilns which are to be destroyed. It was estimated the expansion would cost $120,000.[6]

The Superior Stone Co. reported production of 1 million tons of crushed limestone valued at $1.5 million for concrete aggregate and road metal, a decrease of 17 percent in tonnage and 15 percent in value below 1953.

The North Carolina State Highway and Public Works Commission reported the production of 5,500 short tons of paving sand.

There were 20 operators reporting mica production in 1954 compared with 11 in 1953. Total county production was a little larger than in 1953 and both scrap and flake mica were reported.

Producers of 500 pounds or more of sheet mica were: L. Rex Boone (Cliff Blanton mine), Claude Willis (Lutz mine), and S. C. Cook (Newton and Cook mines). The 3 operators credited with 500 pounds or more in 1953 reported no production in 1954.

In addition, 256 pounds valued at $2,538 were reported from undisclosed sources.

DMEA participated in the exploration of 8 mica properties for a total of $25,910 of which the Government's share was $22,160. DMEA also assisted Foote Mineral Co. to explore for columbium, tantalum, beryl, and tin at Kings Mountain.

Cleaton Humphries mined a considerable tonnage of paving sand.

Columbus.—North Carolina State Highway and Public Works Commission reported production of 52,400 tons of paving sand.

Craven.—North Carolina State Highway and Public Works Commission reported production of 22,500 tons of paving sand.

Cumberland.—The Ideal Brick Co. mined 45,000 tons of clay for use in the manufacture of heavy clay products.

The North Carolina State Highway and Public Works Commission reported production of 55,200 tons of paving sand.

The Bryan Rock & Sand Co. mined structural sand and gravel and the Beeker County Sand & Gravel Co. produced sand and gravel for structural and paving use and for railroad ballast.

[6] Brick and Clay Record, August 1954, p. 33.

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TABLE 14.—DMEA exploration projects' contracts in force in Cleveland County, 1954

Contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
L. Rex Boone	Cliff Blanton	Mica	Jan. 25, 1952	$5,650	90
Burns Spangler Construction Co.	Lee Cornwall	do	Mar. 2, 1953	6,700	90
		Columbium, Tantalum.			
Foote Mineral Co.	Williams & Solvay	Beryllium, Tin.	May 18, 1953	30,500	90
Joe A. Beasley	Lee Carpenter	Mica	Sept. 21, 1953	7,000	90
E. R. Wellmon	Wellmon mine	do	Sept. 28, 1953	5,010	90
Joe A. Beasley	Hubert Cook No. 2	do	Oct. 27, 1953	5,050	90
Barn-Gay Mining Co.	Humphries	do	Nov. 19, 1953	2,600	90
Willis & Snyder Mining Co.	Lutz	do	Jan. 26, 1954	7,625	75
Sam Phillips & C. J. Keller	C. Ray Wilson	do	July 28, 1954	1,400	75

Currituck.—The North Carolina State Highway and Public Works Commission reported production of 30,000 tons of paving sand.

Dare.—The North Carolina State Highway and Public Works Commission reported production of 10,000 tons of paving sand.

Davidson.—The Cunningham Brick Co. (Thomasville mine) mined 32,150 short tons of clay for the manufacture of heavy-clay products. This represented an increase of 16 percent in tonnage over 1953. J. H. Cunningham, Jr., vice-president and general manager, announced the completion of a new 393-foot Miller kiln-dryer combination as a first step in increasing the efficiency of the plant.[7]

The Superior Stone Co. quarried 244,000 short tons of crushed basalt valued at $324,000 from its Bluestone quarry.

The North Carolina State Highway and Public Works Commission reported production of 31,000 tons of paving sand and 155,500 tons of paving gravel.

Paul Hartley mined a small tonnage of commercial sand and gravel.

The total mineral production of Davidson County was valued at $460,000 in 1954 compared to $126,500 in 1953.

Davie.—Sand and gravel was the only mineral product from the county in 1954. Noncommercial products amounting to 5,500 short tons of paving sand were accounted for by the North Carolina State Highway and Public Works Commission. Ira Pope & Son, produced some commercial sand for building and railroad ballast.

Duplin.—The North Carolina State Highway and Public Works Commission reported production of 11,700 tons of paving sand.

Durham.—The Borden Brick & Tile Co. continued to operate its Durham mine for clays to use in manufacturing heavy clay products. Production was about 90 percent of 1953.

The Nello L. Teer Co. quarried 245,000 short tons of crushed granite valued at $368,000 for concrete aggregate and road metal.

Forsyth.—The Piedmont Quarry Co. and W. E. Graham & Son quarried crushed granite for concrete aggregate and road metal for a total county production of 565,000 short tons valued at $834,000.

[7] Brick and Clay Record, September 1954, p. 46.

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The North Carolina State Highway and Public Works Commission reported production of 77,000 tons of paving sand.

G. G. Black, Carl Spaugh, and Paul Miller mined structural sand.

Franklin.—The North Carolina State Highway and Public Works Commission reported production of 4,500 tons of paving sand.

Gaston.—Kendrick Brick & Tile Co. continued to mine clay from its Mount Holly mine for the manufacture of heavy clay products but at a somewhat reduced rate compared to 1953.

The George press for dry-pressing hollow tile emerged from the pilot plant at Kendrick Brick & Tile Co. plant into full scale operation and proved successful after the initial shakedown. Two presses were incorporated in the production line, both are fully automatic.[8]

Earnest Crowder mined a small tonnage of beryl and also produced a substantial quantity of sheet mica from the Huskins mine.

T. Claude Self produced a small quantity of sheet mica from the Harrelson mine.

Gates.—The North Carolina State Highway and Public Works Commission reported production of 35,000 tons of paving sand.

Graham.—The North Carolina State Highway and Public Works Commission reported production of 50,000 tons of crushed granite valued at $62,500 for concrete aggregate and road metal. The commission also reported production of 52,500 tons of paving gravel valued at $39,400.

Granville.—The North Carolina State Highway and Public Works Commission reported production of 4,320 tons of paving sand.

Greene.—The North Carolina State Highway and Public Works Commission reported production of 60,000 tons of paving sand.

Guilford.—The Pleasant Garden mine of the Boren Clay Products Co. continued to produce clays to use in manufacturing heavy clay products. Production continued at approximately the same rate as in 1953.

Buchanan Stone Co. (Buchanan quarry), Superior Stone Co. (Rueben and Jamestown quarries), and Pioneer Quarries Co. (Pioneer quarry) produced a total of 1.25 million tons of crushed granite valued at $1.75 million. Whitlow Bros. (producers in 1953 from High Point quarry) did not report production in 1954. Superior Stone Co. reopened the Jamestown quarry (formerly Whitlow Bros.) in 1954 and operated it in addition to its Rueben quarry.

The North Carolina State Highway and Public Works Commission reported production of 11,700 tons of paving sand and 35,000 tons of crushed granite for concrete aggregate and road metal.

The total mineral production for Guilford County in 1954 was valued at $1.9 million compared with $1.3 million in 1953.

Halifax.—The H. & H. Mining Co. of Enfield reported the production of ore concentrate yielding 214 ounces of gold, 438 ounces of silver, 360 pounds of copper, and 4 tons of lead.

Harnett.—The Norwood Brick Co. continued to mine clays for its use in manufacturing heavy clay products.

The North Carolina State Highway and Public Works Commission reported the production of 35,000 tons of paving sand.

[8] Brick and Clay Record, September 1954, p. 38.

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Haywood.—Everett L. Poston (Shining Rock mine) and Putnam Bros. (Putnam mine) continued to mine sheet mica. Some scrap mica was recovered by Poston.

The North Carolina State Highway and Public Works Commission reported production of 10,000 tons of crushed granite for concrete aggregate and road metal and 146,000 tons of paying gravel.

DMEA participated in two exploration projects for mica in 1954.

TABLE 15.—DMEA mica-exploration projects, Haywood County, 1954

Contractor	Property	Contract		
		Date	Total amount	Government participation, percent
E. L. Poston & J. Bradley	Old Sharp mine	Sept. 24, 1953	$3,270	90
Everett L. Poston	Old Shining Rock mine	do	4,170	90

Henderson.—The Moland Drysdale Corp. continued operation of its Etowah mine and initiated production from its Fletcher mine producing a total of 50,500 short tons of clays for use in manufacturing heavy clay products.

The North Carolina State Highway and Public Works Commission reported production of 4,600 tons of crushed granite from the Dana quarry for use as concrete aggregate and road metal.

The Fletcher Limestone Co. and the Coghill Limestone Co. continued to operate their respective quarries for crushed limestone as concrete aggregate and road metal. Production was roughly 20 percent above 1953.

J. R. Freeman (Mauldin mine) and B. R. Tolly (Nancy mine) mined a small quantity of sheet mica.

Hertford.—Paving sand in the amount of 25,000 tons mined by the North Carolina State Highway and Public Works Commission was the only mineral production.

Hoke.—The North Carolina State Highway and Public Works Commission reported 4,880 tons of paving sand in 1954.

Hyde.—The North Carolina State Highway and Public Works Commission reported 1,000 tons of paving sand.

Iredell.—The North Carolina State Highway and Public Works Commission reported production of 11,000 tons of paving sand.

The Statesville Brick Co. reported clay production from its Statesville mine at roughly three times that of 1953.

R. B. Little (Little mine) reported mining a small quantity of sheet mica.

Jackson.—Harbison-Walker continued production of olivine from its Addie mine at a somewhat reduced rate compared with 1953.

The North Carolina State Highway and Public Works Commission reported production of 143,500 tons of paving gravel.

Twelve operators reported production of sheet and/or scrap mica; in addition, a small output was reported without credit for its source.

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Those mining 500 pounds or more of sheet mica were Goodmica Mining Co. (Engle Cope and Murray Mountain mines), Cox Mica Co. (Cox mine), and H. S. Zigler (Buchanan mine).

Three producers reported production of scrap mica.

DMEA participated in five exploration projects for mica.

TABLE 16.—DMEA mica-exploration projects for mica in Jackson County, 1954

Contractor	Property	Contract		
		Date	Total amount	Government participation, percent
Goodmica Mining Co	Engle Cope mine	May 7, 1953	$6,750	90
Hooper Bros	Old Sheep Mountain mine	May 19, 1953	9,900	90
Latt Young	Cox mica mine	Sept. 28, 1953	7,300	90
Chas. B. Hensley	Betty's Creek No. 3	Dec. 14, 1953	5,350	90
Goodmica Mining Co	Murray Mountain mine	Jan. 19, 1954	7,475	90

Johnston.—The only mineral production was 32,500 tons of paving sand by the North Carolina State Highway and Public Works Commission.

Jones.—Sand and gravel was the only mineral production, of which the North Carolina State Highway and Public Works Commission reported 20,000 tons of sand for paving. The Simmons Marl & Limestone Co. mined commercial paving sand.

Lee.—The Sanford Brick & Tile Co., the Borden Brick & Tile Co., and the Lee Brick & Tile Co. continued production of clays for their own use in manufacturing heavy clay products. Total production was 15 percent above 1953 and the highest on record.

The North Carolina State Highway and Public Works Commission reported production of 1,800 tons of paving sand.

TABLE 17.—Miscellaneous clay sold or used by producers in Lee County, 1949–54

Year	Short tons	Value	Year	Short tons	Value
1949	236,860	$194,360	1952	348,600	$397,200
1950	280,250	280,250	1953	314,000	378,800
1951	310,000	355,000	1954	360,831	418,564

Lenoir.—Sand and gravel constituted the only mineral production of the county.

The Barrus Construction Co. mined paving sand, and the North Carolina State Highway and Public Works Commission reported production of 70,000 tons of similar material.

Lincoln.—The North Carolina State Highway and Public Works Commission reported production of 6,000 tons of paving sand.

Four producers reported production of sheet mica from five mines; and, in addition, a small production was recorded without credit for its source.

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Producers were Southeastern Mica & Feldspar Co. (Foster mine), DeWitt Hoyle (Beam mine), T. Claude Self (Houser and Williams mines) and C. F. Speagle (Wyantt mine).

Macon.—The North Carolina State Highway and Public Works Commission reported production of 100,000 tons of paving sand.

Sheet mica was mined from 29 operations and totaled 106,500 pounds valued at $279,600. Some scrap and flake mica was marketed also.

Producers of sheet mica each credited with 500 pounds or more were: Mica Development Corp. (Chalk Hill mine), A. W. Reid (Mill Knob mine), J. R. Berry (Rock Cut mine), Mayland Mining Co. (Iotla Bowers mine), Roy H. Fouts (Allman Cove mine), Mud Cut Mining Co. (Mud Cut mine), Ellis and Carpenter (Iota Bradley mine), Mica Industries, Inc. (Rose Creek No. 1 mine), and Hiram Tallent (Roby mine).

Total value of mineral production from Macon County in 1954 was $447,000 compared with $349,000 in 1953.

The DMEA contributed to 10 mica projects in 1954.

TABLE 18.—DMEA mica-exploration projects in Macon County, 1954

Contractor	Property	Contract		
		Date	Total amount	Government participation, percent
Burke-John Mica Miners	Burke-John	Oct. 1, 1952	$8,100	90
Zeb Angel	Kasson	Dec. 12, 1952	9,200	90
Macon Mica Miners	Mashburn	Dec. 22, 1952	5,200	90
Polly Miller Mica Corp	Polly Miller	Mar. 16, 1953	7,700	90
B. T. R. Mining Co	Terrell Bryson	June 25, 1953	4,900	90
Roy H. Fouts	Allman Cove	July 2, 1953	7,540	90
Hardy C. Cable	Passmore	July 9, 1953	7,100	90
Sam L. Phillips et al	Mud Cut	June 1, 1954	10,838	75
Duval et al.—c/o P. S. Meeker	Bryson No. 2	July 8, 1954	4,700	75
A. Ward	Elmore	Nov. 18, 1954	5,064	75

Madison.—The Feldspar Producing Co. reported a small tonnage of mixed potash and soda feldspar.

Martin.—The North Carolina State Highway and Public Works Commission reported production of 3,000 tons of paving sand.

McDowell.—The North Carolina State Highway and Public Works Commission reported production of 90,000 tons of crushed limestone valued at $102,000 of this, 82,000 tons valued at $93,000 was for concrete aggregate and road metal, 7,000 tons valued at $8,500 was for agricultural purposes, and 1,000 tons valued at $500 was for other unspecified purposes.

Four operators reported production of sheet mica; in addition, a small quantity was recorded without credit to its source.

Producers were: J. S. Souther (Tom's Creek mine), T. R. Carver (Prospect, Bear Stump, and Robinson mines), Fred Young (Hector mine) and Ted Stewart (Flat Rock mine).

Mecklenburg.—The North Carolina State Highway and Public Works Commission quarried 7,800 tons of crushed granite valued at $11,700 for concrete aggregate and road metal.

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Mitchell.—The value of mineral production in Mitchell County in 1954 was $3,791,000 compared with $4,400,000 in 1953—a 14-percent decline.

Linton B. Green and Paul Pitman accounted for a small production of beryl but increased the quantity above that in 1953.

Roy Grindstaff reported a small production of kaolin, and Harris Clay Co. continued mining at its Sparks mine.

The Feldspar Flotation Co. (Wiseman and Poteat mines), and the International Minerals & Chemical Corp. (Kona and Spruce Pine) continued to separate quartz as a byproduct of feldspar production. Total production exceeded that of 1953, but total value dropped.

Although 15 operators reported feldspar production in 1954 compared with 14 in 1953, there was a substantial decrease in both tonnage and value from 1953.

Sheet and scrap mica were produced from 137 deposits in 1954 compared with 60 in 1953. In addition 7,700 pounds of sheet mica valued at $82,000 was recorded from the county but unidentified as to original producer.

Total sheet-mica production was 131,000 pounds valued at $955,000. Total scrap and flake mica was 27,700 tons valued at $649,000. This represents almost twice the quantity and total value for sheet mica compared with 1953 but a reduction in average unit value per pound from $8.63 in 1953 to $7.32 in 1954. Scrap-mica production was higher in both tonnage and total value.

From the 133 or more properties operated for sheet mica the following 17 operators were credited with 1,000 pounds or more: Deer Park Mines, Inc. (Deer Park mine), Edgar E. Buchanan (Spread Eagle and Old Clarissa mines), Abernathy Mining Co. (Abernathy mine), Sink Hole Miners (Sink Hole mine), Paul Hoppes (Tater Chip mine), Thomas & Grindstaff (Geo. Howell mine), Hawkins Mining Co. (Long Cut mine), Julius Henline (Big Clay Hole and Sam Silvers mines), M. E. Burleson (Blackburn mine), Woodrow Duncan (Prospect mine), John Phillips (Jeff Sparks mine), H. Lee Medford (Peterson mine), Gudger Mining Co. (Gudger mine), Miller Mining Co. (Miller mine), Powder Mill Mining Co. (Banks mine), Lewis Crowder (Crowder mine), and Oakley Buchanan (Metcalf mine).

DMEA participated in 13 mica-exploration projects.

TABLE 19.—DMEA mica-exploration projects, Mitchell County, 1954

Contractor	Property	Contract		
		Date	Total amount	Government participation percent
Sinkhole Miners	Sinkhole	July 1, 1952	$35,756	90
B & R Mica Co	Half Moon	May 14, 1953	11,650	90
Duncan Mining Co	Connolly	June 15, 1953	8,800	90
Byrd Mica Miners	Byrd	Nov. 3, 1953	5,755	90
Zeb Buchanan et al	Borden	Dec. 30, 1953	6,825	90
N. Buchanan et al	Johnson	Mar. 22, 1954	6,500	75
F.O. Phillips	Phillips	July 28, 1954	4,193	75
John Jarrett	Jarrett	Sept. 7, 1954	4,538	75
Jeter & Howard Boone	Doc Thomas	Sept. 21, 1954	5,748	75
Mine Creek Mica Miners	Geo. Howell	Oct. 5, 1954	6,124	75
Zeb Buchanan et al	R. B. Phillips	Oct. 11, 1954	4,016	75
H. Boone & J. Jarrett	Marsh-Putnam	Oct. 28, 1954	5,292	75
Audy Pittman	Wiseman No. 2	Nov. 8, 1954	6,316	75

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Montgomery.—The Mount Gilead Brick Co. continued mining clay for its use in the manufacture of heavy clay products.

The North Carolina State Highway and Public Works Commission reported the production of 25,000 tons of paving sand.

Moore.—Production of pyrophyllite by the Glendon Pryophyllite Co. and the Standard Mineral Co. was roughly 90 percent of that in 1953.

The other mineral production of the county was sand. The North Carolina State Highway and Public Works Commission reported 10,000 tons of noncommercial paving sand.

There were 6 producers of sand from 7 pits in 1954 compared with 3 from 9 pits in 1953. As a result, combined production was increased 80 percent above 1953, but total value increased only 46 percent. This indicates a reduction in average unit value of 18 percent or 10 cents a ton. All production reported was sand for building, paving, and filler markets with no gravel produced.

Producers reporting both years were Bryan Rock & Sand Co. (Aberdeen and West End pits), Monroe sand pit, and Harrison sand pit. New producers for 1954 were Pleasant Sand & Supply Co., T. M. Reid sand pit, and Aberdeen Sand & Gravel Co.

Nash.—The Nash Brick Co. continued mining clay for use in the manufacture of heavy clay products. Production in 1954 was about 11 percent below 1953.

The North Carolina State Highway and Public Works Commission reported production of 24,000 tons of paving sand.

New Hanover.—E. L. Robbins Co. continued to mine sand for fertilizer filler and the North Carolina State Highway and Public Works Commission mined 6,200 tons of paving sand.

Northampton.—Grant Brick Works continued to produce clays from its Weldon mine for use in manufacturing heavy clay products. Production was off about 13 percent compared with 1953.

The Bryan Rock & Sand Co. continued production of structural and paving sand and gravel, and the North Carolina State Highway and Public Works Commission mined 33,000 tons of paving sand.

The total value of mineral production for the county increased appreciably above 1953.

Onslow.—The Superior Stone Co. quarried 360,000 tons of crushed limestone or roughly about one-half the 1953 production.

The North Carolina State Highway and Public Works Commission reported production of 8,500 tons of paving sand.

Orange.—The North State Pyrophyllite Co. reported initial production of pyrophyllite from its Hillsboro mine, and the North Carolina State Highway and Public Works Commission reported the production of 13,000 tons of paving sand.

Pamlico.—The only mineral production was 20,000 tons of paving sand by the North Carolina State Highway and Public Works Commission.

Pasquotank.—The only mineral production was 25,000 tons of paving sand by the North Carolina State Highway and Public Works Commission.

Pender.—The only mineral production was 9,000 tons of paving sand by the North Carolina State Highway and Public Works Commission.

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Perquimans.—The only mineral production was 34,000 tons of paving sand by the North Carolina State Highway and Public Works Commission.

Person.—The only mineral production was 11,000 tons of paving sand by the North Carolina State Highway and Public Works Commission.

Pitt.—The only mineral production was 124,000 tons of paving sand by the North Carolina State Highway and Public Works Commission.

Polk.—J. C. Williams quarried 250 tons of dimension granite for rubble, and the North Carolina State Highway and Public Works Commission reports the production of 50,000 tons of paving gravel.

Randolph.—The Carolina Pyrophyllite Co. reported continued production of pyrophyllite from its Staley mine but at a somewhat lower rate than in 1953.

The North Carolina State Highway and Public Works Commission reported production of 208,000 tons of crushed granite for concrete and road metal from the Glenola and Parks Cross roads quarries and 8,000 tons of paving sand.

Richmond.—The only mineral production was 3,700 tons of paving gravel by the North Carolina State Highway and Public Works Commission.

Robeson.—The only mineral production was 79,000 tons of paving gravel by the North Carolina State Highway and Public Works Commission.

Rockingham.—Clay mining for the manufacture of heavy clay products was continued by the Pine Hall Brick & Pipe Co., and new production was reported by the Roanoke-Webster Brick Co. Total production was greater than in 1953.

H. A. Knight, Sr. (Knight mine), and H. A. Knight, Jr. (Knight No. 3 mine), mined sheet mica.

The North Carolina State Highway and Public Works Commission reported production of 102,000 tons of miscellaneous stone for concrete aggregate and road metal and 3,100 tons of paving sand.

Rowan.—The Harris Granite Co. (Balfour and Salisbury quarries) quarried and processed 587 tons of stone for grinding pebbles and tube-mill liners valued at $12,125. During 1953 this company operated the Balfour quarry only, preparing 150 tons of pebbles valued at $2,600, and 420 tons of tube-mill liners valued at $7,550.

The Gardner Granite Works also quarried abrasive materials for millstones and chasers.

The Isenhour Brick & Tile Co. continued to produce shale for use in manufacturing heavy clay products.

During the fall of 1953 the Salisbury Granite Co. (Salisbury quarry) was acquired by the Harris Granite Co. which in 1954 operated the Salisbury, Collins, and Balfour quarries for the production of dimension granite. The J. A. Logan Granite Co. continued to operate in 1954 and G. M. Earnhardt began production. Dimension granite was quarried and prepared for the trade as rubble, building and monumental stone, paving, and curbing.

The Superior Stone Co. operated the Woodleaf quarry and opened a new quarry known as the Kanapolis for the production of crushed granite.

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Superior Stone Co. was the only crushed granite producer in 1954; the Harris Granite Co.'s Carolina quarry was closed. Total county production of crushed granite for concrete aggregate, road metal, and railway ballast was 54 percent greater than 1953.

W. A. Kepley mined a small tonnage of paving gravel, and the North Carolina State Highway and Public Works Commission reported production of 23,000 tons of paving sand.

TABLE 20.—Granite (crushed and dimension) sold or used by producers in Rowan County, 1949–54

Year	Short tons	Value	Year	Short tons	Value
1949	414,271	$715,532	1952	548,351	$1,216,044
1950	530,931	1,030,616	1953	482,446	1,167,823
1951	410,782	877,460	1954	741,907	1,265,051

The total value of mineral production from Rowan County in 1954 was $1,412,000, compared with $1,339,000 in 1953.

Rutherford.—The Bostic Brick & Tile Co. continued to produce clay for manufacturing heavy clay products.

E. B. Connelly (Huntsinger mine), Grady Campbell (Toney mine), and Fite and Bennick (Sweesy mine) mined small quantities of sheet or scrap mica.

A. R. Thompson mined a substantial tonnage of paving gravel.

Sampson.—Both the Crumpler Brick Co. and the Sampson Brick Co. continued to produce material for manufacturing heavy clay products. The Patterson Brick Co. began production in 1954.

The North Carolina State Highway and Public Works Commission reported production of 12,200 tons of paving sand.

Scotland.—The only mineral production reported was 3,500 tons of paving sand by the North Carolina State Highway and Public Works Commission.

Stanly.—The Yadkin Brick Yards, Inc., and the Stanly Shale Products Co. continued to mine and burn shale for manufacturing heavy clay products. In February 1954 the Carolina Solite Corp. initiated a new industry for North Carolina; namely, the conversion of raw shale to lightweight aggregate.

Stokes.—The Pine Hall Brick & Pipe Co. continued to operate its No. 1 and No. 2 mines to obtain shale for heavy clay products. The company announced a new expansion plan in its sewer pipe operations and plans to build a new brick plant equipped with 2 combination tunnel kilns with a daily capacity of 80,000 units.[9]

The North Carolina State Highway and Public Works Commission reported production of 85,000 tons of paving sand.

Surry.—The North Carolina Granite Corp. continued operation of its Mount Airy quarry for the production of dimension granite.

W. E. Graham mined 291,000 tons of paving gravel valued at $285,000.

Swain.—Granite for dimension building stone was obtained from the Needmore Quarries and Nantahala Talc & Limestone Co. quarried limestone for concrete aggregate, road metal, and agricultural stone.

[9] Brick and Clay Record, October 1954, p. 33.

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Feldspar production in 1954 increased considerably at the Alexander mine, which was taken over by the Feldspar Milling Co. from the Blue Ridge Mining Co.

The North Carolina State Highway and Public Works Commission reported production of 128,000 tons of paving gravel.

Transylvania.—The Powhatan Mining Co. continued to mine a small tonnage of short-fiber asbestos from its Kilpatrick mine.

The North Carolina State Highway and Public Works Commission reported production of 10,000 tons of crushed granite for concrete aggregate and road metal.

James E. Moore (Broom mine), J. C. Kitchen (Phillips mine), and Merrell, Rose & Robinson (Utah mine) mined and marketed a small quantity of sheet mica.

Tyrrell.—The only mineral output was 1,000 tons of paving sand produced by the North Carolina State Highway and Public Works Commission.

Union.—Kendrick Brick & Tile Co. continued to operate its Monroe mine for raw material in manufacturing heavy clay products.

Superior Stone Co. quarried 417,000 tons of basalt valued at $700,000 from its Bakers quarry for concrete aggregate, road metal, and railway ballast.

Vance.—The Tungsten Mining Corp. mined and milled tungsten ore to produce 2,538 tons of concentrate (60-percent WO_3 basis), an increase of 22 percent above 1953.

Greystone Granite Co. quarried 782,000 tons of crushed granite valued at $968,000 for riprap, concrete aggregate, and railway ballast. This represents a 26-percent increase above 1953. Jeter Thomas produced some sheet mica from a small prospect.

Wake.—Bryan Rock & Sand Co. continued to operate its Rolesville crushed-granite quarry for concrete aggregate and road metal and also produced some stone sand. The company opened the new Crabtree quarry and produced crushed granite from there for concrete and road metal. The North Carolina State Highway and Public Works Commission reported production of 1,500 tons of paving sand.

Washington.—The only mineral production reported was 19,000 tons of paving sand by the North Carolina State Highway and Public Works Commission.

Watauga.—The Butler Mica Co. reported production of a small tonnage of feldspar.

Roy Keplar (Southerland mine) and the Butler Mica Co. (Watauga mine) mined a small quantity of sheet mica.

The North Carolina State Highway and Public Works Commission reported production of 4,200 tons of building gravel.

Wayne.—The North Carolina State Highway and Public Works Commission reported production of 26,000 tons of paving sand; and the Bryan Rock & Sand Co. continued to produce building sand, but at a lower rate than in 1953.

Wilkes.—Mat Goins (Groundhog mine), R. L. Auton (Hall mine), M. W. Key (Wilkes County mine), and W. L. Clark (Welch mine) mined and marketed sheet and/or scrap mica.

Wilson.—The Bryan Rock & Sand Co. continued to operate its Neverson crushed-granite quarry for concrete aggregate and road metal and stone sand.

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The North Carolina State Highway and Public Works Commission reported production of 12,300 tons of paving sand.

Yadkin.—J. E. Dooley reported initial production of crushed granite for concrete and road metal.

Yancey.—The Mining & Milling Corp. of America continued to mine short-fiber asbestos from its Blue Rock mine. Production was down from 1953.

C. P. Wiseman operated the Wray mine for a small tonnage of olivine.

Production of vermiculite by the Variegated Vermiculite Co. was somewhat less than in 1953.

Salem A. Badger mined a small quantity of beryl.

There were 5 active producers of feldspar operating 9 mines for a total of 12,800 tons of crude ore valued at $106,000. This compares with 6 operators and 9 mines producing 8,900 tons valued at $86,000 in 1953, or an increase of 44 percent in tonnage and 23 percent in total value. This is the equivalent of a decrease in average value a ton of $1.38 or 14 percent. Producers reporting in 1954 were: Feldspar Producing Co. (Gibbs, Bowditch B, Smith No. 1, and Thomas mines), Feldspar Milling Co. (Mud Hole and Webb mines), Ray Cook (Bee Ridge mine), Lewis Edge (Swannanoa mine), and Williams & Buchanan (Dayton mine).

Sheet and/or scrap mica was reported from 66 mines in 1954 compared with 31 in 1953. In addition, 843 pounds of sheet mica valued at $8,900 was reported from the county without identification of deposit source. The county total was 28,100 pounds of sheet mica valued at $112,000 compared with 98,600 pounds valued at $171,300 in 1953, a decrease of 71 percent in quantity but only 35 percent in total value. This represents an increase in unit value per pound from $1.74 in 1953 to $3.98 in 1954, or 129 percent, reflecting a better grade of marketed material.

Scrap mica was reported from 20 deposits; in 15 the mineral source was pegmatite, and in 5 the material came from mica schist or as a byproduct in kaolin production. Total county scrap production was 22,170 tons valued at $496,000 compared to 25,000 tons valued at $605,000 in 1953. This represents a reduction of 11 percent in quantity and 18 percent in total value. The average unit value per ton dropped from $24.20 in 1953 to $22.37 in 1954.

The major producers of sheet mica (500 pounds or over) were: McCurry and Edge (Chestnut Branch mine), Glenn Rathbone (Robbers Roost and White Oak mines), Yancey Mica Mines, Inc. (Cat Tail mine), James Fox (Renfro mine), Charles Hyatt (Green Mountain mine), John Blalock (Presnell mine), Cook Mining Co. (Charlie Robinson mine), and Consolidated Mica Co. (Celo mine).

The major producers of scrap mica were: From pegmatite—Ed's Realty Co. Inc. (Carolina Mica Co. mine), Dineen Mica Co. (Harris Clay Co. mine), De-Weld Mica Corp. (Hall's Chapel mine), and Consolidated Mica Co. (Celo mine); and from schist or kaolin—Southern Mica Co. of North Carolina (Grindstaff, Robinson and Briggs mines) and Hassett Mining Co. (Simpson and Edge mines).

The total value of mineral production from Yancey County in 1954 was $757,000 compared with $946,000 in 1953.

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Fourteen DMEA mica exploration projects were active in 1954 compared with 13 in 1953.

TABLE 21.—DMEA mica-exploration projects, Yancey County, 1954

Contractor	Property	Contract		
		Date	Total amount	Government participation, percent
Murphy Mining Co	Bennett-Red	July 2, 1953	$4,550	90
Blue Ridge Mica Co	Grant Laws	May 28, 1953	7,500	90
Carolina Clear Mica Co	Clear	Sept. 24, 1953	11,575	90
Hyatt & Presnell	Banks	Sept. 28, 1953	7,270	90
Robert K. Andre	Old McKinney	Nov. 3, 1953	6,100	90
Cook Mining Co	Chas. Robinson	Dec. 14, 1953	12,470	90
Nonmetallic Minerals Corp	White Face	Mar. 5, 1954	3,300	75
Hector Mining Co	Hector	Mar. 22, 1954	5,325	75
Young & Burleson	Ruby	June 24, 1954	4,350	75
C. L. Brown & G. C. Rathburn	Fox	July 22, 1954	5,788	75
Phillips & Carpenter	W. A. McKinney	July 30, 1954	3,613	75
W. B. Chrisawn	Westall	Aug. 2, 1954	3,363	90
South Toe Mining Co	Carson Rock	Sept. 9, 1954	4,900	75
Rock Mining Co	Rock	Sept. 21, 1954	3,938	75

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The Mineral Industry of North Dakota

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the State Geological Survey of North Dakota.

By Frank J. Kelly[1] and Breck Parker[1]

THE VALUE of North Dakota mineral production rose to a new high in 1954—16 percent higher than in 1953. Most important to the State economy was the continued growth of the petroleum industry. Output of crude petroleum, stimulated by construction of 3 refineries and 2 pipelines, increased both in quantity and in value per unit.

Production of natural-gas liquids was reported in 1954 for the first time.

Some of the production data for 1954 were collected jointly with the Bureau of Census. Production totals will be compared with the Bureau of Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

TABLE 1.—Mineral production in North Dakota, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	23,084	$47,862	(2)	(2)
Coal (lignite)	2,802,558	6,617,980	(2)	(2)
Natural gas, million cubic feet	498	34,000	1,093	$69,000
Petroleum (crude), thousand 42-gallon barrels	5,183	10,370,000	6,025	[3] 12,890,000
Sand and gravel	6,173,737	2,164,685	7,105,466	2,219,747
Stone	35,031	2,595	1,419	3,784
Undistributed: Nonmetallic minerals and minerals indicated by footnote 2				7,040,820
Total		19,237,000		22,223,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Value included with "Undistributed."
[3] Final figure. Supersedes preliminary figure given in commodity chapter.

[1] Commodity-industry analyst, Region III, Bureau of Mines, Denver, Colo.

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REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—The demand for raw clay for the manufacture of brick and other structural clay products and for use in lightweight aggregate increased sharply in 1954, compared with 1953. The bulk of the State output resulted from mining activities in Morton County by the Hebron Brick Co. and Molite, Inc. The Marion Clay Works operated a small clay pit in Adams County. All clay mined was of the common clay or shale variety, except for a small quantity of bentonite. Use was split evenly between brick and heavy clay products and lightweight aggregate. The bentonite was used in foundries as a bonding agent for molding sand.

Sand and Gravel.—Sand and gravel production by commercial and Government-and-contractor operations was reported in 29 of the State 53 counties in 1954. The quantity of material sold or used increased 15 percent over the 1953 total, but because of the lower

TABLE 2.—Sand and gravel sold or used by producers in North Dakota, 1953–54, by classes of operation and uses

Class of operation and use	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Building	208,898	$214,710	$1.03	213,035	$212,784	$1.00
Paving	24,074	22,374	.93	56,570	52,338	.93
Engine	240	41	.17			
Other	686	214	.31	5,813	10,606	1.82
Total commercial sand	233,898	237,339	1.01	275,418	275,728	1.00
Gravel:						
Building	502,065	811,288	1.62	227,025	328,496	1.45
Paving	1,060,855	634,367	.60	164,533	123,261	.75
Railroad ballast	208,076	124,682	.60	481,868	423,352	.88
Other	48,769	10,696	.22	292,059	345,025	1.18
Total commercial gravel	1,819,765	1,581,033	.87	1,165,485	1,220,134	1.05
Total commercial sand and gravel	2,053,663	1,818,372	.89	1,440,903	1,495,862	1.04
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand: Paving	29,160	2,160	.07			
Gravel:						
Building	46,175	2,181	.05	1,600	80	.05
Paving	4,044,739	341,972	.08	5,662,963	723,805	.13
Total Government-and-contractor gravel	4,090,914	344,153	.08	5,664,563	723,885	.13
Total Government-and-contractor sand and gravel	4,120,074	346,313	.08	5,664,563	723,885	.13
ALL OPERATIONS						
Sand	263,058	239,499	.91	275,418	275,728	1.00
Gravel	5,910,679	1,925,186	.33	6,830,048	1,944,019	.28
Grand total	6,173,737	2,164,685	.35	7,105,466	2,219,747	.31

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average price paid in 1954, the total value increased only 3 percent compared with 1953. Of the 7.1 million tons produced in 1954, 5.7 million tons (80 percent) was produced by private contractors engaged in various highway projects. In reviewing table 2, it can be noted that production of higher cost commercial sand and gravel decreased from 2.1 million tons in 1953 to 1.4 million tons in 1954. On the other hand, as a result of contracts let by the State and county highway departments, production (Government-and-contractor) increased from 4.1 million tons in 1953 to 5.7 million tons in 1954, a 38-percent gain. Because of increased statistical coverage in 1954, figures for 1954 are not entirely comparable with 1953; however, enough data are available to indicate a significant increase in output in 1954.

Stone.—The State highway department did not quarry any stone for road use in 1954, and only a small quantity of crushed sandstone used as riprap was reported by the Federal Bureau of Reclamation.

Vermiculite.—Exfoliated vermiculite used for insulation plaster, concrete aggregate, and soil conditioner was produced by Robinson Insulation Co. at its plant at Minot, Ward County. The crude vermiculite came from out of State.

MINERAL FUELS

Coal (Lignite).—Confidentiality arising from the census precludes the publication of a figure on lignite for 1954 comparable with 1953. Production and value of North Dakota lignite for 1954 are included in the United States total to avoid disclosure, on the basis of census data, of individual company operations in other States. However, the published annual report of the State coal-mine inspector indicates that the output declined only slightly in the fiscal year ending June 30, from 1953 to 1954.

The Federal Bureau of Mines published material describing lignite-mining methods and costs in North Dakota; the technology and utilization of European lignite; possible industrial uses of lignites of the United States; and some technical aspects of combustion, carbonization, gasification, and hydrogenation of these coals.[2]

Natural Gas.—Marketed producton of natural gas from oil and gas wells doubled in 1954 over the previous year and rose from 9 percent to 13 percent of the total production; withdrawal not marketed was vented and wasted. No new gas wells were drilled during the year. North Dakota continued to draw most of its supply of natural gas from other States. The quantity brought in was 3,890 million cubic feet compared with 20 million cubic feet delivered to out-of-State markets. During 1954 the State consumed 4,963 million cubic feet in residential, commercial, and industrial uses.

Natural-Gas Liquids.—North Dakota produced its first natural gasoline and liquefied-petroleum gases in 1954.

At Tioga in Williams County, Signal Oil & Gas Co. completed and placed in operation a natural-gasoline plant with a daily natural-gas capacity of 65 million cubic feet.

Petroleum.—Crude-petroleum output in 1954 increased 16 percent over 1953 and was accompanied by a 24-percent gain in gross value.

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[2] Bureau of Mines, Technology of Lignitic Coals, Parts 1 and 2: Inf. Circ. 7691 and 7692, 1954, 142 and 120 pp.

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The advances were due chiefly to establishment of a domestic refining industry in the State, with resulting expanded market and higher prices for crude.

The industry continued to intensify its exploration and development efforts, as measured by drilling activity, and completed 312 holes, compared with 268 in 1953 and 122 in 1952. New discoveries in 1954, however, were costly, and the wildcat success ratio achieved (1 in 29) was the poorest in the oil-producing Rocky Mountain States.

North Dakota had 4 oil discoveries in 1954—3 by Amerada Petroleum Corp. and 1 by Hunt Oil Co. In the Nesson Creek anticline area, Amerada brought in the White Earth field in Mountrail County, and Hunt Oil Co. was credited with discovery of the McGregor-Madison pool in Williams County. In addition, Amerada found a productive second zone in the Fryburg field of Billings County, and, to the northeast, gave Stark County its first production with discovery of the Belfield area. Considering the results obtained and wildcat success ratio, this year's new oil was not won easily.

TABLE 3.—Petroleum production in North Dakota by counties, 1953–54, in barrels

County	1953	1954	Producing fields in 1954
Billings	36,000	145,000	Fryburg.
Bottineau	23,000	41,000	Landa-NE, Westhope, Westhope-N.
Burke	16,000	31,000	Tioga.
McKenzie	107,000	389,000	Charlson, Croff, Keene, Sanish-W.
Mountrail	903,000	1,286,000	Tioga, Tioga-E, White Earth.
Stark	----------	(1)	Belfield.
Williams	4,098,000	4,133,000	Beaver Lodge, Capa, Hofflund, McGregor, Tioga.
Total	5,183,000	6,025,000	

[1] Less than 500 barrels.

Preliminary data released by the Bureau of Census [3] show the cost of drilling and equipping the average 5,390-foot dry hole in North Dakota during 1954 to have been $64,100. The average oil well was 8,340 feet deep and cost $122,500.

These costs exclude taxes, interest on investments, overhead, and value of material that has been salvaged. They include cost of labor, supplies, water, fuel, and power used in such operations as erecting and dismantling rigs and derricks, drilling holes, running and cementing casing, hauling materials and installing equipment; machinery and tool charges or rentals; delivered and installed cost of equipment such as tubing, wallhead fittings, gas traps, flow tanks, etc., and drilling or special-production derricks; the amount obligated to contractors for any of the above materials, equipment, or services; and cost of salvaging any material for reuse.

The census classification of dry and oil wells is only approximately comparable to the wildcat-development classification in table 4, as 4 oil wells are included with the wildcat wells and 15 dry holes with the development holes.

[3] Bureau of Census, 1954 Census of Mineral Industries (Preliminary Report), Crude Petroleum and Natural Gas: Series MI-13-1, October 1956.

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TABLE 4.—Wildcat and development well completions in North Dakota, by counties, 1954

[Oil and Gas Journal]

County	Oil	Gas	Dry	Total	Footage[1]
Wildcat					
Benson			14	14	41,300
Billings	1		1	2	23,400
Bottineau			7	7	29,400
Bowman			2	2	20,600
Burleigh			5	5	32,000
Cavalier			2	2	2,800
Dickey			4	4	7,500
Divide			2	2	16,300
Dunn			4	4	44,100
Eddy			1	1	3,900
Emmons			1	1	4,400
Foster			2	2	5,800
Golden Valley			3	3	35,400
Grand Forks			1	1	900
Hettinger			1	1	10,400
Kidder			1	1	5,900
Logan			1	1	5,100
McHenry			1	1	3,800
McIntosh			5	5	17,300
McKenzie			2	2	25,900
Morton			1	1	5,000
Mountrail	1		3	4	38,900
Pierce			10	10	36,300
Ramsey			1	1	1,300
Renville			1	1	5,400
Rolette			11	11	35,700
Sheridan			4	4	26,700
Sioux			1	1	5,900
Slope			1	1	9,000
Stark	1		2	3	29,700
Stutsman			9	9	34,100
Towner			1	1	1,300
Ward			2	2	17,000
Wells			4	4	19,000
Williams	1		2	3	26,400
Total wildcat	4		113	117	627,900
Development					
Billings	7			7	65,900
Bottineau	4		4	8	26,200
Burke	2		1	3	24,400
McKenzie	19			19	168,100
Mountrail	40		3	43	361,000
Williams	108		7	115	972,800
Total development	180		15	195	1,618,400
Total drilling	184		128	312	2,246,300

[1] Footage has been rounded to nearest 100 feet.

Most important to North Dakota oil industry was the installation in 1954 of a 34,000-barrel-per-day refining capacity within the State. In October Standard Oil Co. of Indiana completed a 30,000-barrel-per-day skimming and cracking plant at Mandan, Morton County. Coincident with the initial and later full production of this plant (December), Stanolind Oil Purchasing Co. raised the price of crude from $2.00 to $2.50 and later to $2.90. Similarly, the State allowable production was raised from 15,225 barrels per day to 20,180 in October and to more than 30,000 at the end of the year.

Two other refineries also were completed during the year. Queen City Oil & Refining Co. placed in operation a 2,500-barrel-per-day skimming and cracking plant at Dickinson, Stark County, and Williston Basin Refining Corp. completed a similar plant of 1,500-barrel-per-day capacity at Williston, Williams County.

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Tying together productive areas, refining facilities, and markets were two newly installed pipelines. A 16-inch pipeline connected the Tioga-field area to Mandan, supplying crude to the new refinery. From Mandan eastward to Moorhead, Minn., Standard Oil Co. of Indiana constructed an 8-inch products line to carry refinery output, in excess of local demand, into its midwestern market area.

Before 1954 North Dakota producers had limited and distant markets. The necessary high transportation charges to the Midwest and Pacific Northwest placed North Dakota crude in a poor competitive position and limited demand.

METALS

Uranium.—The Atomic Energy Commission and the Geological Survey continued investigation of uraniferous lignites in southwestern North Dakota during the year. North Dakota lignites were known to contain uranium in quantities of less than 0.01 percent U_3O_8. In August 1954 lignitic material containing 0.10 percent and more U_3O_8 was discovered in the northern Cave Hills of northwestern South Dakota. By the year end the ensuing land rush had extended well into western and southwestern North Dakota.

REVIEW BY COUNTIES

Williams County was by far the major mineral-producing county in North Dakota, with an output valued at nearly $9 million—about 42 percent of the State total. Although 40 of the 53 counties in the State reported production, concentration of mineral production in the 11 adjoining northwestern counties furnished over 80 percent of the total State value.

Owing to the lack of adequate detail on sand and gravel production by counties, 63 percent of the total tonnage of this commodity necessarily was credited to the undistributed section in the county table.

Adams.—The Marion Clay Works at Hettinger produced a small quantity of common clay used to manufacture brick and other structural clay products. The county also produced lignite.

Benson.—Paving sand and gravel was produced by the Concrete Sectional Culvert Co., which employed 6 men for 300 days in its quarrying and fabricating activities. The county highway department also quarried sand and gravel for road construction. Of 14 unsuccessful wildcat holes completed, Shell Oil Co. drilled 13 and National Bulk Carriers-Smith & Summers drilled 1. A total of 41,300 feet was drilled.

Billings.—Petroleum production from the Fryburg field, discovered in 1953, was 145,000 barrels of 41° gravity crude from 9 wells. Two wildcats were completed during the year, 1 dry by Stanolind Oil & Gas Co., and 1 successful by Amerada Petroleum Corp., which brought in a new productive zone in the Fryburg field. Additional development drilling in the field by Amerada also was carried out.

Bottineau.—The county nearly doubled its oil production in 1954 to produce 41,000 barrels of 36°–37° gravity crude. Of the county's three fields, the Westhope-North field was primarily responsible for the gain. Completed were 7 unsuccessful wildcat holes and 8 develop-

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ment holes, of which 4 were dry. The exploration and development effort was expended by Cardinal Drilling Co., Ward-Williston Drilling Co., Calvert Exploration Co., and others.

TABLE 5.—Value of mineral production in North Dakota, excluding uranium, in 1953–54, by counties [1] [2]

County	1953	1954	Minerals produced in 1954, in order of value
Adams	$95,466	$520	Clays, coal.
Benson	21,112	39,391	Sand and gravel.
Billings	72,770	310,000	Petroleum.
Bottineau	45,922	88,000	Do.
Bowman	308,624	(3)	Coal, natural gas.
Burke	1,013,214	117,663	Coal, petroleum, sand and gravel.
Burleigh	314,441	(3)	Sand and gravel, coal.
Cass	(3)		
Divide	628,026	(3)	Coal.
Dunn	32,789	(3)	Do.
Eddy		35,716	Sand and gravel.
Foster	1,041	1,200	Do.
Grand Forks	87,245	45,000	Do.
Grant	81,151	794	Coal, sand and gravel.
Griggs	2,885	2,614	Sand and gravel.
Hettinger	36,713	12,202	Coal, sand and gravel.
McHenry	14,544	(3)	Sand and gravel.
McIntosh	14,218	1,038	Do.
McKenzie	219,388	832,000	Petroleum, coal.
McLean	706,309	153,340	Coal, sand and gravel.
Mercer	2,251,289	(3)	Coal.
Morton	243,427	(3)	Sand and gravel, coal, clays, petroleum.
Mountrail	1,808,086	(3)	Petroleum, sand and gravel.
Nelson	56,128	25,453	Sand and gravel.
Oliver	13,973	(3)	Coal.
Pierce	(3)	4,053	Sand and gravel.
Ramsey	58,087		
Ransom	3,116	1,101	Do.
Renville	753,050	(3)	Do.
Richland	4,675	11,826	Do.
Rolette	44,955	3,130	Do.
Sargent	2,646	3,400	Do.
Sheridan	7,198	10,672	Do.
Stark	206,368	71,225	Coal, sand and gravel, petroleum.
Stutsman	149,187	5,479	Sand and gravel.
Traill	(3)	36,077	Do.
Walsh	10,208	95,101	Do.
Ward	1,337,610	265,636	Coal, sand and gravel.
Wells	20,464	(3)	Sand and gravel.
Williams	8,311,895	8,918,966	Petroleum, sand and gravel, coal.
Undistributed [4]	258,902	11,131,754	
Total	19,237,000	22,223,000	

[1] The following counties are not listed because no production was reported: Barnes, Cavalier, Dickey, Emmons, Golden Valley, Kidder, La Moure, Logan, Pembina, Sioux, Slope, Steele, Towner.
[2] Value of coal (1954), natural gas (1954), natural-gas liquids (1954), some sand and gravel, and stone (1954), are excluded from county totals and included with "Undistributed" to avoid disclosure of individual company operations.
[3] Value included with "Undistributed."
[4] Includes value of minerals excluded from county totals (indicated by footnote reference 2) and value of minerals by county that must be concealed for particular years (indicated by footnote reference 3).

Bowman.—Lignite and natural gas were produced in the county. Two 10,000-foot wildcat wells were completed and abandoned; Hunt Oil Co. and Zach-Brooks Drilling Co. placed the No. 1 State, and Western Natural Gas Co. abandoned its No. 1 Truax-Traer.

Burke.—Lignite, petroleum, and sand and gravel, in that order, were the county's chief mineral commodities. The Tioga field was extended into the county during the year by Warren Petroleum Corp., which tied into a hole successfully completed in 1953. As a result, the county was credited with 31,000 barrels of Tioga production. Three development wells (2 successful and 1 dry) were completed for a total of 24,400 feet by the company.

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Susag Sand & Gravel Co. produced structural sand and gravel for the county construction industry. Sandberg Sand & Gravel Co. also produced structural sand and gravel and 30,000 tons of paving gravel for road use. The Burke County engineer reported that county highway contracts resulted in the production of 28,350 tons of paving gravel.

Burleigh.—Sand and gravel and lignite were produced in the county. Burleigh was one of the more important sources of sand and gravel in the State, and the commodity provided three-quarters of the county mineral output. All reported production of sand and gravel in 1954 was supplied by the Dakota Sand & Gravel Co. Five dry wildcat holes were completed for a total of 32,000 feet by the Caroline Hunt Trust Estate.

McKenzie.—The county ranked third in petroleum production, with 389,000 barrels of light crude oil (42°–46° gravity) produced from its 4 fields—Charlson, Sanish-West, Croff, and Keene, in order of importance. Development activity was concentrated in the Charlson area, where 16 out of a total of 19 development wells were drilled by The Texas Co., Amerada Petroleum Corp., and Hunt Oil Co. The county also produced a small quantity of lignite.

McLean.—The county was a major producer of both lignite and sand and gravel. The bulk of the sand and gravel was produced by the Minneapolis, St. Paul & Sault Ste. Marie Railroad Co., which quarried 128,000 tons of gravel for railroad ballast. The remainder of the output resulted from contracts let by the county and State highway departments.

Morton.—Sand and gravel, lignite, and clay, in order of value, comprised the county mineral output in 1954. Morton County was the largest producer of clay in the State and one of the more important producers of sand and gravel. Hebron Brick Co. operated its brick plant, producing building brick and other structural clay products; a small quantity of bentonite was shipped to foundries by the company. Molite, Inc., of Mandan mined clay and produced a "bloated" shale for use as a lightweight aggregate.

The only reported producer of sand and gravel in 1954 was the Riverside Gravel Co., which quarried and prepared structural and paving sand and gravel, as well as a small quantity of mortar sand.

Standard Oil Co. of Indiana completed and placed in operation a 30,000-barrel-per-day skimming and cracking refinery at Mandan in October; full operation was achieved in mid-December. The plant processed crude petroleum, which was transported via pipeline to Mandan from the Tioga-field area. Refined products were sold locally and within the State, and the surplus was shipped by pipeline to middle western markets.

Mountrail.—Mountrail County was the second most important oil producer and was also an important producer of sand and gravel. In 1954 the county's oil fields—White Earth, Tioga-East, and part of Tioga—produced 1,286,000 barrels of crude. The White Earth field was discovered in March 1954 by Amerada Petroleum Corp. in sec. 2, T. 157 N., R. 94 W. At year end this field had 8 wells, which had produced 81,000 barrels of 39° gravity crude. Wildcat and development wells in the county numbered 47 and totaled 400,000 feet.

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Stark.—Lignite, sand and gravel, and crude petroleum, in order of value, were produced in Stark County during 1954. The county had its first petroleum production in 1954, with the discovery by Amerada Petroleum Corp. of the Belfield field in September. At year end no further development had taken place, and the field was "shut in" after 377 barrels had been produced. At Dickinson the Queen City Oil & Refining Co. placed in operation a 2,500-barrel-per-day skimming and cracking plant—1 of the State's 3 new refineries constructed in 1954. In addition, petroleum exploration was carried out by Hunt Oil Co. and Sun Oil Co., one dry wildcat hole being drilled by each. Commercial sand and gravel was produced by Badinger Sand & Gravel Co. and Fisher Sand & Gravel Co.

Williams.—Williams County produced petroleum, sand and gravel, and lignite; two-thirds of the State output of crude petroleum came from the county's five fields—Beaver Lodge, Capa, Hofflund, McGregor, and part of Tioga. The McGregor field was discovered in May 1954 by Hunt Oil Co. and added 36,000 barrels of 40° gravity crude to the county's total by the end of the year. One hundred and eighteen wells totaling 999,000 feet were drilled during the year; Amerada Petroleum Corp. was by far the most active, followed by Hunt Oil Co. and others.

Williston Basin Refining Corp. placed in operation a 1,500-barrel-per-day refinery at Williston. Also a natural-gasoline processing plant was completed at Tioga by Signal Oil & Gas Co. The plant has a daily natural-gas capacity of 65 million cubic feet.

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The Mineral Industry of Ohio

By Norwood B. Melcher [1] and James R. Kerr [2]

THE VALUE of mineral production in Ohio in 1954 dropped 1 percent below that of 1953. The 7-percent drop in coal production, with the resulting loss in value, had the greatest effect in lowering the value of the State output, although natural gas and lime dropped 27 and 11 percent, respectively, in value of production. Commodities showing increased value include salt (65 percent), peat (37 percent), petroleum (10 percent), and cement (9 percent). The total output of stone, sand and gravel, and clay showed little change from 1953.

Ohio maintained its position as the leading producer of grindstones and clay and lime; it was second leading in stone but dropped from second and third place to third and fifth in the production of peat and salt.

TABLE 1.—Mineral production in Ohio, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement.....376-pound barrels	12,532,437	$32,957,308	13,076,921	$35,929,163
Clays	5,634,596	9,327,706	5,051,478	11,136,478
Coal	34,736,773	131,475,408	32,468,728	117,519,936
Lime	2,945,800	35,310,353	2,549,046	31,444,083
Natural gas.....million cubic feet	37,542	8,334,000	28,824	6,111,000
Peat	27,696	260,474	29,540	356,970
Petroleum (crude)..thousand 42-gallon barrels	3,610	9,710,000	3,880	10,710,000
Salt (common)	3,040,237	7,484,795	2,748,993	12,358,521
Sand and gravel	24,032,388	27,076,276	25,827,220	27,873,469
Stone	[2] [3] 25,285,782	[2] [3] 39,041,308	32,626,737	47,802,169
Undistributed: Abrasive stones, gypsum, natural gasoline, natural salines, sand and sandstone (ground) 1953, stone (dimension unclassified 1953), elemental sulfur		1,264,540		2,084,098
Total		302,242,000		[4] 293,659,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes certain stone which is included with "Undistributed."
[3] Excludes limestone for cement and lime in 1953 which is included in 1954.
[4] Totals have been adjusted to avoid duplication of value of limestone for cement and lime, which are included in the value of cement and lime.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Production of coal in Ohio declined 7 percent below the preceding year but production mined by surface methods increased again in 1954, reflecting the trend in Ohio in recent years toward more surface mining. Reasons for this trend are: Easy accessibility to most

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Ohio coal from the surface; the use of larger earth-moving machinery, making possible the cheap removal of more overburden and exposing deep-lying seams for exploitation; the increased use of coal-recovery augers, which extend economic barriers by continuing to mine under the highwall after maximum strip depth has been reached; and the ability to produce and sell strip coal cheaper because less manpower is involved and the heavy costs connected with underground mining are not encountered.

In connection with the development of larger earth-moving equipment, the Hanna Coal Co., Division of Pittsburgh Consolidation Coal Co., has announced plans for constructing a 2,500-ton power shovel to be built by the Marion Power Shovel Co., Marion, Ohio. A huge 60-cubic-yard bucket will expose seams at hitherto economically unminable depths of 90 feet or more. When completed, the unit will be 50 percent larger than any existing equipment of its kind. Its unique features are: (1) A million pounds of ballast necessary to counterbalance the weight of the boom; (2) an overall height of 145 feet (as high as a 12-story building); (3) an office-type, 3-passenger elevator through the 6-foot-diameter center pin to the control section; and (4) 16 motors generating 4,500 hp.

Auger mining showed a marked increase in 1954; 6 counties reported production in 1953 and 11 in 1954. Meigs County, which did not report auger production in 1953, mined over half of the State total in 1954.

The first step in an attempt to eliminate expensive coal-haulage freight rates was taken by the Pittsburgh Consolidation Coal Co., the world's major producer of bituminous coal. Plans are underway for developing a 110-mile coal pipeline from mines near Cadiz, Ohio, to the Cleveland Electric Illuminating Co., at Eastlake, near Cleveland. Costs are expected to be cut $1.25 per ton from present rail rates, and it is hoped that low-cost coal can attract new industries to the area. Crushed coal, one-eighth inch in diameter, will be slurried with water and pumped through the line at high pressure. Pittsburgh Consolidation has been successfully operating an experimental 10-mile unit in Ohio for some time.

Coal production was concentrated in the eastern section of the State where coal-bearing measures underlie 30 counties. Over 50 coal beds have been identified, of which 17 were commercial under existing

TABLE 2.—Bituminous coal production, 1945–49 (average) and 1950–54

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1945–49 (average)	34,453,743	$119,527,528	$3.47	1952	36,208,450	$138,090,700	$3.81
1950	37,761,091	143,852,921	3.81	1953	34,736,773	131,475,408	3.78
1951	37,948,692	146,677,710	3.87	1954	32,468,728	117,519,936	3.62

mining and economic conditions. Twenty-five counties reported coal production in 1954. Of the total tonnage, 63 percent was strip-mined, 3 percent auger-mined, and 34 percent mined underground. Virtually all underground production was cut by machine; 86 percent was

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mechanically loaded and 14 percent hand-loaded into mine cars or onto conveyors. The major producing counties, in order of descending value, were Harrison, Belmont, Jefferson, Tuscarawas, and Noble; the major producing companies were Hanna Coal Co., Division of Pittsburgh Consolidation Coal Co., St. Clairsville; Powhatan Mining Co., Cleveland; Youghiogheny & Ohio Coal Co., Cleveland; and Sunnyhill Coal Co., New Lexington.

Peat.—The major output of peat in 1954 was from Wyandot County; other producing counties were Summit, Richland, Stark, Portage, and Mahoning. Although production rose 7 percent above 1953, Ohio dropped from second to third place as a peat-producing State; Florida was second. Peat is used as a fuel in other countries, but the abundance of higher rank fuels in the United States has kept peat out of the fuel and energy markets; instead, it is utilized for mulch and other soil-conditioning purposes.

Petroleum and Natural Gas.—Production of petroleum rose 7 percent, compared with 1953. Oil-well drilling continued at a high rate despite temporary Corning-grade-crude proration and a price decline during the third quarter of the year. Near the close of 1954 market conditions improved considerably when a second refinery began to accept Corning crude.

Natural-gas shipments decreased 23 percent from 1953. Although the value of gas at the wellhead dropped from $0.222 to $0.212 per 1,000 cubic feet, it was still well above the national average of $0.101 per 1,000 cubic feet.

The Ohio Geological Survey reported 459 oil, 248 gas, 81 combination, and 407 dry-well completions in 1954.[3] Of the wells drilled, 34.1 percent were failures or dry holes. The average depth of new gas wells was 1,730 feet, oil wells 1,844, and combinations 3,053. The practice of applying hydraulic fracture to producing zones to increase natural production continued. In 1954 Ohio had 685 wells producing under 2,500 feet, 489 wells in the 2,500- to 5,000-foot classification, and 8 in the 5,000- to 7,500-foot classification; there were no wells deeper than 7,500 feet.

The leading counties in the discovery of new gas pools included Tuscarawas, Perry, Cuyahoga, Guernsey, Athens, and Coshocton; 1 Clinton; 1 Oriskany; and 2 Berea-sand gas pools were developed. New-pool developments were approximately 4,100 acres and extensions to existing pools approximately 8,500 acres. The largest and most unusual gas pool was discovered by the Ohio Fuel Gas Co.—the Mary Paxson well No. 1 in Bearfield Township, Perry County. The well was to have been drilled to the Clinton sand (more than 3,000 feet), but at 489 feet in the Injun sand, 6.5 million cubic feet of gas was discovered unexpectedly.

The leading counties in the discovery of new oil pools were Coshocton, Knox, Licking, Perry, and Muskingum. Ten new oil pools were found during 1954—9 in the Clinton sand and 1 in the Oriskany. Approximately 4,000 acres proved to be productive as a result of new drilling. The major producing oil well was the F. E. Edwards, Harry Stone, in Washington Township, Hocking County, where 1,200 barrels was produced from the Clinton sand the first 24 hours after fracture.

[3] Alkire, Robert L., 1954 Oil and Gas Developments in Ohio: Div. of Geol. Survey, Dept. of Natural Resources, Rept. of Investigations 24, 1955, 58 pp.

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In addition to petroleum and natural gas, natural gasoline was produced by two absorption plants.

NONMETALS

Cement.—Shipments of Ohio portland cement increased 4 percent in 1954, compared with 1953. Stocks on hand, as of December 31, 1954, were 30 percent higher. The average price per barrel increased to $2.75 from $2.63. Raw material for manufacturing cement was obtained in most instances from company-owned quarries. Of the 9 companies reporting, 8 quarried the bulk of the raw material. The major producers were Southwestern Portland Cement Co. and Universal Atlas Cement Co., Fairborn, Greene County; and Pittsburgh Plate Glass Co., East Fultonham, Muskingum County.

Marquette Cement Manufacturing Co. initiated a long-range, multi-million-dollar expansion at its cement plant in Superior, Ohio. Plans called for the immediate remodeling and overhauling of the facilities and constructing a new crushing plant. Universal Atlas Co. was proceeding with construction at its Fairborn plant, adding a rotary kiln and expanding the facilities to increase capacity one-third.

The demand for cement was heavy in the northern counties as construction of the Ohio Turnpike continued. More competition was experienced in other sections, although the demand was good.

TABLE 3.—Finished portland cement produced, shipped, and in stock, 1945–49 (average) and 1950–54

Year	Active plants	Production (barrels)	Shipments from mills			Stocks at mills on Dec. 31 (barrels)
			Barrels	Value		
				Total	Average per barrel	
1945–49 (average)	9	8,474,065	8,498,845	$16,029,295	$1.89	635,013
1950	9	10,606,739	10,512,004	24,012,983	2.28	853,982
1951	9	11,873,852	11,872,278	29,498,956	2.48	855,548
1952	9	11,270,431	11,377,806	28,488,500	2.50	748,541
1953	9	12,539,132	12,532,437	32,957,308	2.63	755,237
1954	9	13,306,570	13,076,921	35,929,163	2.75	984,886

Clays.—The clays industry in Ohio developed from a modest origin in 1841 as a single fire-clay pit, near East Liverpool, to No. 1 producer in the Nation today. The majority of the plants are in the eastern and southeastern sections of Ohio, where excellent fire clay and large deposits of shale, combined with abundant supplies of coal and natural gas, make this possible. Clay production, however, is not restricted to the eastern section of the State. Deposits cover the entire State, ranging from alluvial and glacial deposits in the west to widespread shale deposits in the central and north sections.

The total clay production dropped 10 percent, compared with 1953; but there was a 19-percent increase in the value of production, because the price of fire clay, rose from $2.20 per ton in 1953 to $3.18 per ton in 1954. Fire clay composed 50 percent of the total production and 75 percent of the total value of clays. The bulk of fire clay (69 percent) was used in manufacturing heavy clay products, such as building brick, draintile, and sewer pipe. Ohio produces more clay

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sewer pipe than any other State, with about 25 operating plants. Thirty-three percent of the fire-clay production was used in the manufacturing refractories and 3 percent in making high-grade tile and pottery. Of the miscellaneous-clay total, 92 percent was used in manufacturing heavy-clay products, 6 percent as aggregate, and 2 percent for high-grade tile and refractories.

Construction initiated during the year included the $1 million Belden Brick Co. plant at Sugarcreek, the $3 million expansion by Natco Corp. at East Canton, and the $½ million expansion of the South Park plant, Hydraulic Press Brick Co.

Some pottery and dinnerware manufacturers are operating at 65- to 70-percent capacity owing to increased competition from foreign markets. It is estimated that 35 percent of the total dinnerware sold in the United States is foreign-made.

TABLE 4.—Clays sold or used by producers, 1953–54, by counties

County	1953		1954	
	Short tons	Value	Short tons	Value
Carroll	180,128	$397,874	184,795	$324,831
Columbiana	493,438	706,821	377,983	1,275,004
Cuyahoga	409,096	331,090	273,243	289,493
Hocking	189,257	250,614	172,265	721,298
Jackson	141,918	334,258	128,849	446,118
Jefferson	217,567	345,030	185,925	631,674
Lawrence	228,043	1,038,566	138,494	562,846
Paulding	19,933	55,666	18,002	45,644
Perry	197,231	308,077	264,038	407,468
Putnam	26,306	55,162	18,315	36,425
Stark	579,692	824,967	597,814	1,441,260
Summitt	59,283	88,025	33,670	33,670
Tuscarawas	1,022,976	1,745,355	1,049,495	2,282,197
Undistributed [1]	1,869,728	2,846,201	1,608,590	2,638,550
Total	5,634,596	9,327,706	5,051,478	11,136,478

[1] Includes data for the following counties: Belmont (1954), Darke, Delaware, Franklin, Hancock, Harrison, Henry, Highland, Holmes, Huron, Lake, Licking (1954), Madison, Mahoning, Marion, Medina, Muskingum, Noble, Portage, Richland, Scioto, Seneca, Van Wert, Vinton, Washington, Wayne, Williams, Wood, Wyandot.

Production in 43 counties was reported in 1954 from 138 clay pits, including 31 underground mines. Tuscarawas was the leading county, producing about one-fourth of the State total; Stark and Columbiana were large producers. The major producing companies included Natco Corp., Stark County; Davidson Mining, Inc., Tuscarawas County; and American Fire Clay & Products Co., Mahoning County.

Grindstones.—Grindstones were produced by the Nicholl Stone Co. at Kipton in Lorain County; and by Constitution Stone Co. and Hall Grindstone Co., both of Constitution, in Washington County.

Gypsum.—Formations outcropping along the shores of Sandusky Bay were the sources of the gypsum mined in Ohio in 1954. Production increased 43 percent over 1953, reflecting renewed activity in the construction industry. Ottawa County was the only producer, with Celotex Corp., at Port Clinton, and United States Gypsum Co., at Gypsum, reporting mining activity in 1954. The primary uses of the product were in making wallboard and lath.

Lime.—In terms of value, the output of lime in 1954 ranked fourth among the mineral industries of the State, compared with third in 1953. Although production dropped 13 percent during the year, Ohio main-

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TABLE 5.—Clays sold or used by producers in 1954, by kinds and uses, in short tons

Use	Fire clay	Miscellaneous clay	Total
Refractories:			
Firebrick and block	509, 950		509, 950
Fire-clay mortar	18, 452	(1)	18, 452
Foundries and steelworks	299, 103		299, 103
Kiln furniture: saggers, pins, stilts	265		265
Zinc retorts and condensors	638		638
Other	17, 118	6, 803	23, 921
Total refractories	845, 526	6, 803	852, 329
Heavy clay products	1, 645, 978	1, 719, 117	3, 365, 095
Pottery and stoneware: Stoneware, including chemical stoneware	6, 615		6, 615
Tile, high-grade	66, 506	43, 050	109, 556
Portland and other hydraulic cements		609, 034	609, 034
Agricultural terra cotta	3, 643		3, 643
Lightweight aggregate		104, 847	104, 847
Other (miscellaneous)	359		359
Grand total	2, 568, 627	2, 482, 851	5, 051, 478

[1] To avoid revealing individual company totals, miscellaneous clay for manufacturing fire-clay mortar is included with other refractories.

tained its position as the foremost producer in the United States. Agricultural and chemical and industrial uses increased 31 and 13 percent, respectively, while building and refractory uses decreased 7 and 35 percent, respectively. The trend in recent years toward increased use of lime in the industrial and chemical industries continued. This increase, and a sharp drop in refractory uses, caused industrial and chemical lime to assume the most important uses in the State, chiefly as metallurgical flux and in making glass. Lime was also used in the building and agricultural industries. Of the 16 producers in 10 counties reporting in 1954, the largest were the Columbia Southern Chemical Corp., at Barberton, Summit County; Basic Refractories, Inc., Maple Grove, Seneca County; and United States Gypsum Co., Genoa, Ottawa County. The bulk of total lime production was from Sandusky County, where 34 percent was produced.

TABLE 6.—Lime (quick and hydrated) sold by producers, 1945–49 (average) and 1950–54, by types

Year	Agricultural (burnt)		Building		Chemical and other industrial		Refractory		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	52, 442	$482, 931	427, 339	$4, 719, 518	398, 022	$3, 316, 319	784, 910	$8, 301, 273	1, 662, 713	16, 820, 041
1950	51, 904	595, 105	632, 632	8, 678, 435	390, 571	3, 876, 436	1, 067, 237	13, 123, 122	2, 142, 344	26, 273, 098
1951	47, 092	519, 367	623, 236	8, 290, 569	437, 891	4, 491, 313	1, 181, 254	15, 744, 947	2. 289, 473	29, 046, 196
1952	53, 467	637, 589	578, 088	8, 009, 903	407, 007	4, 139, 066	1, 166, 870	15, 606, 702	2. 205, 432	28, 393, 260
1953	52, 376	618, 108	556, 537	8, 328, 900	922, 655	7, 350, 473	1, 414, 232	19, 012, 872	2, 945, 800	35, 310, 353
1954	68, 460	889, 070	516, 679	8, 133, 692	1, 040, 082	9, 135, 604	923, 825	13, 285, 717	2, 549, 046	31, 444, 083

Magnesium Compounds.—Diamond Alkali Co., Lake County, produced refractory magnesia from raw dolomite.

Natural Salines.—Calcium chloride was produced from well brine by the Pomeroy Salt Corp., at Minersville, Meigs County.

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Perlite.—Expanded perlite was processed by four companies in Ohio in 1954 from crude material from southwestern United States (mostly Colorado and New Mexico). The manufactured products were used primarily as lightweight aggregate in making concrete and plaster.

Salt.—Beds of rock salt in Ohio (in the Salina formation of the upper Silurian) have been utilized on a commercial basis since 1899 for manufacturing artificial brines. Salt beds underlie most of the eastern edge of the State and vary in depth from 1,850 feet at Cleveland to 2,600 feet at Rittman and 4,700 feet at Freeport to 6,400 feet at Bellaire. Salt is a basic raw material of the chemical industry and a natural resource of great value to Ohio.

Producing counties in 1954 were Lake, Meigs, Summit, and Wayne. Six companies reported salt production; the major ones were Diamond Alkali Co., Plainsville, Lake County, and Columbia Southern Chemical Corp., Barberton, Summit County. Production dropped 10 percent, compared with 1953. The major part of the production (82 percent) was sold as brine and the remainder (18 percent) as evaporated salt. The bulk of the brine was used in manufacturing chlorine and soda ash; evaporated salt was sold primarily for chemical uses and soap (including detergents) and considerable quantities went to feed dealers and meatpackers.

Ohio ranked fifth among the States in salt production in 1954.

TABLE 7.—Salt sold or used by producers, 1945–49 (average) and 1950–54, by kinds

Year	Evaporated		Brine		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	448,174	$3,930,096	2,218,840	$1,268,439	2,667,014	$5,198,535
1950	472,966	4,274,738	2,042,239	1,216,815	2,515,205	5,491,553
1951	479,246	3,908,141	2,633,226	1,940,337	3,112,472	5,848,478
1952	461,289	4,189,883	2,366,166	1,801,743	2,827,455	5,991,626
1953	498,438	5,175,816	2,541,799	2,308,979	3,040,237	7,484,795
1954	482,906	5,361,838	2,266,087	6,996,683	2,748,993	12,358,521

Sand and Gravel.—A great boon to road building and construction in Ohio is the widespread occurrence of sand and gravel deposits which cover over two-thirds of the State. Most of the sand and gravel deposits are in the northern glaciated part of the State, but melting ice carried large quantities beyond glacial boundaries. Other sources of sand and gravel are river and lake deposits.

Production increased 7 percent, compared with 1953. By far the most important use of sand and gravel was for building and paving, 87 percent being used for this purpose. Sand and gravel also was utilized as raw materials in manufacturing glass, for railroad ballast, and for polishing, grinding, filtering, and refractory purposes. Because of the commodity's great bulk and low unit value, which tend to limit the shipping distance, the output was marketed locally. Seventy of the 88 counties in the State reported production in 1954. The more important, in order of decreasing value of production, were Hamilton, Portage, Montgomery, and Franklin. Of the 274 pits

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TABLE 8.—Sand and gravel sold or used by producers, 1953–54, by uses

Use	1953		1954	
	Short tons	Value	Short tons	Value
Sand:				
Molding	578,740	$1,721,459	334,537	$968,418
Structural	5,444,457	5,445,785	6,003,104	6,314,504
Paving	3,363,564	3,153,538	4,422,172	4,079,043
Fire or furnace	69,139	164,594	(1)	(1)
Engine	81,856	133,450	(1)	(1)
Filter	37,321	39,590	47,607	88,354
Railroad ballast	23,677	19,927	(1)	(1)
Other [2]	632,192	1,542,355	548,992	911,515
Gravel:				
Structural	3,734,072	3,981,481	5,167,568	5,625,946
Paving	7,384,423	8,060,943	7,025,445	7,713,627
Railroad ballast	870,489	629,880	382,022	293,920
Other	1,812,458	2,183,274	1,895,773	1,878,142
Total sand and gravel	24,032,388	27,076,276	25,827,220	27,873,469

[1] Included with other sand to avoid disclosure of individual company operations.
[2] Includes glass and polishing, blast, fire or furnace, engine, and railroad-ballast sand.

TABLE 9.—Commercial sand and gravel sold or used by producers, 1953–54, by counties

County	1953			1954		
	Number of pits	Short tons	Value	Number of pits	Short tons	Value
Ashtabula	4	123,631	$115,834	5	175,071	$155,455
Athens	3	69,325	81,727	2	(1)	(1)
Auglaize	3	297,796	284,864	4	291,802	313,288
Butler	10	940,343	869,254	9	965,560	973,228
Champaign	3	(1)	(1)	2	(1)	(1)
Clark	5	294,176	309,029	7	288,489	282,322
Coshocton	10	285,609	287,211	9	292,021	288,605
Cuyahoga	7	866,046	872,428	11	1,243,025	1,413,000
Darke	6	248,834	249,338	7	1,104,303	1,272,222
Erie	(1)	(1)	(1)	3	47,337	82,560
Fairfield	5	139,069	157,811	5	132,351	150,697
Franklin	4	2,491,234	2,744,006	4	1,603,979	1,703,422
Geauga	7	479,202	648,509	6	503,799	594,350
Greene	3	175,863	164,012	6	238,582	165,414
Hamilton	11	3,295,492	3,880,722	10	3,030,748	3,459,459
Henry	3	70,226	88,287	2	(1)	(1)
Holmes	3	71,302	50,553	3	80,784	74,126
Huron	3	130,047	114,613	4	144,018	141,345
Jefferson	3	345,751	373,003	2	(1)	(1)
Knox	5	382,261	596,616	7	481,804	672,706
Lake	3	116,036	155,516	7	244,497	250,853
Licking	6	409,093	392,966	7	484,254	454,414
Lorain	(1)	(1)	(1)	3	(1)	(1)
Miami	4	271,262	293,647	6	272,805	294,747
Montgomery	9	1,664,222	1,407,782	17	2,215,871	1,834,108
Morgan	(1)	(1)	(1)	3	(1)	(1)
Muskingum	3	(1)	(1)	3	(1)	(1)
Pike	4	413,020	555,592	6	1,084,659	1,199,839
Portage	9	980,301	1,664,013	14	1,442,412	2,021,311
Preble	3	105,946	119,803	3	114,756	125,901
Richland	(1)	(1)	(1)	3	(1)	(1)
Ross	6	858,356	801,687	7	1,251,475	1,079,979
Shelby	5	216,724	251,654	2	(1)	(1)
Stark	7	975,594	923,922	11	1,127,168	1,101,571
Summit	8	503,791	516,150	11	594,806	615,558
Tuscarawas	7	487,598	609,929	9	663,164	719,939
Warren	6	403,563	380,493	6	406,492	367,798
Washington	6	191,706	215,352	4	94,854	92,492
Wayne	5	499,354	442,136	3	(1)	(1)
Williams	4	94,427	72,606	6	289,175	264,877
Undistributed	27	4,776,152	6,148,443	41	4,656,279	5,591,790
Total	220	23,673,352	26,839,508	280	25,566,340	27,757,376

[1] Included with "Undistributed" to avoid disclosing individual company output.

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that were active in 1954, the largest were operated by American Aggregates Corp., Greenville; and Ohio Gravel Co., Cincinnati.

Stone.—The stone industry of Ohio consists of sandstone and limestone mining. The bulk of the product was crushed limestone (98 percent of the tonnage and 84 percent of the value). Eastern Ohio has vast tonnages of limestone at depths now regarded as too great for exploitation. The Columbia Southern Barberton mine, 8 miles south of Akron, is an exception. Here a million tons of limestone per year is extracted at a depth of over 2,200 feet. The top 46 feet of the Columbus formation of the Big Lime series is mined, loaded into 20-ton Tournarockers by 1½-yard electric power shovels, and transported to an underground crusher.

The major producing counties, in order of decreasing value, were Ottawa, Sandusky, Franklin, Lorain, and Summit. One hundred and two companies reported production in 1954; the largest were Kelley Island Co., Cleveland; Marble Cliff Quarries, Columbus; National Lime & Stone Co., Findlay; and Wagner Quarries Co., Sandusky.

TABLE 10.—Stone sold or used by producers, 1953–54, by kinds

Kind	1953		1954	
	Short tons	Value	Short tons	Value
Dimension stone:				
Limestone	17,667	$39,852	37,535	$117,503
Sandstone	167,590	5,358,310	156,074	5,134,475
Total dimension stone	[1] 185,257	[1] 5,398,162	193,609	5,251,978
Crushed and broken stone:				
Limestone	24,957,676	32,398,401	32,022,315	40,139,155
Sandstone	142,849	1,244,745	410,813	2,411,036
Total crushed and broken stone	25,100,525	33,643,146	32,433,128	42,550,191
Grand total	[1] 25,285,782	[1] 39,041,308	32,626,737	47,802,169

[1] Excludes certain stone; Bureau of Mines not at liberty to publish.

Uses of the product include concrete and road stone (37 percent), flux (25 percent), cement and lime (25 percent), chemical and other (4 percent), agricultural (6 percent), and railroad ballast (3 percent).

Sandstone quarrying is one of the older industries but was less important in 1954. Berea sandstone, or "grit," which has been mined commercially for over a century, played an important role in the early economy of Ohio. Amherst was the center of mining of Berea sandstone in 1954; other sandstone formations mined were the Massillon, the Freeport, and the Marietta. Production was reported from eight counties in 1954, the largest being Lorain, Holmes, and Scioto. The major producers were Cleveland Quarries, Lorain County, and Briarhill Stone Co., Holmes County.

Vermiculite.—Exfoliated vermiculite was produced from imported crude material by 1 reporting company in 1954. The product was used for loose fill insulation and as lightweight aggregate.

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TABLE 11.—Limestone sold or used by producers, 1953–54, by counties

County	1953			1954		
	Number of pits	Short tons	Value	Number of pits	Short tons	Value
Adams	(1)	(1)	(1)	1	390, 287	$553, 314
Allen	4	715, 980	$863, 631	4	591, 227	759, 910
Clark	(1)	(1)	(1)	1	80, 975	131, 921
Clinton	(1)	(1)	(1)	1	281, 837	347, 699
Delaware	4	359, 082	419, 234	4	499, 597	656, 562
Fayette	3	714, 903	937, 087	3	563, 373	728, 378
Hamilton	4	44, 567	51, 704	3	(1)	(1)
Hancock	3	420, 438	497, 865	3	(1)	(1)
Hardin	3	387, 794	500, 263	2	(1)	(1)
Harrison	(1)	(1)	(1)	1	163, 380	220, 469
Highland	3	308, 062	414, 302	3	298, 150	405, 333
Lawrence	(1)	(1)	(1)	3	589, 135	633, 147
Logan	3	159, 490	184, 554	2	(1)	(1)
Lucas	4	1, 294, 284	1, 587, 647	4	1, 833, 134	2, 258, 118
Mahoning	(1)	(1)	(1)	1	1, 238, 103	2, 377, 884
Marion	3	772, 853	919, 375	3	(1)	(1)
Miami	(1)	(1)	(1)	1	591, 319	1, 187, 347
Putnam	4	289, 800	368, 160	4	254, 519	332, 470
Sandusky	8	1, 604, 520	2, 223, 804	8	2, 858, 003	3, 606, 887
Seneca	4	889, 857	995, 534	3	2, 101, 672	2, 333, 518
Van Wert	3	230, 089	287, 356	3	249, 023	295, 767
Wood	5	390, 394	490, 152	5	563, 169	709, 087
Undistributed	39	[2] 16,393, 230	21, 697, 585	37	18, 912, 947	22, 718, 847
Total	97	[2] 24,975, 343	32, 438, 253	100	32, 059, 850	40, 256, 658

[1] Included with "Undistributed."
[2] Revised figure.

METALS

There was no mine output of metalliferous ores in Ohio in 1954; however, proximity to natural waterways and abundant power resources attracted metal-processing plants to Ohio. An example is the iron and steel industry, located primarily along Lake Erie and the Ohio River, which ranks second only to Pennsylvania in blast-furnace capacity and steelmaking facilities.

During the year plans were made by the Electro-Metallurgical Co., Division of Union Carbide & Carbon Corp., for building a $30-million titanium sponge plant at Ashtabula. With a 10,000-ton annual capacity, it will be the world's largest plant for this purpose. The company also reported production of the first electrolytic chromium at a new 2,000-ton plant at Marietta. Electromet's development of a commercially feasible source of electrolytic chromium is keyed to its important use in the production of chromium-bearing alloys for jet aircraft.

The new zirconium oxide plant of Zirconium Corp. of America, at Solon, was placed in operation in 1954.

REVIEW BY COUNTIES

Adams.—Crushed limestone for concrete aggregate, road material, railroad ballast, and agricultural purposes was produced in 1954 by the Plum Run Division of New York Coal Co.

Allen.—Crushed limestone was produced by National Lime & Stone Co. and Western Ohio Stone Co., both of Lima; Bluffton Stone Co., Bluffton; and A. J. Suever Stone Co., Delphos. About nine-tenths of the output was utilized for concrete aggregate and road stone; the remainder was consumed as railroad ballast and for agricultural

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purposes. C. E. Duff & Son, Lakeview, mined sand and gravel for building and paving purposes and for railroad ballast.

Ashland.—Sand and gravel, the only mineral produced in Ashland County in 1954, was mined commercially by Bolin & Son Crushed Gravel, Mifflin; and Young's Sand & Gravel Co., Loudonville, from dry-pit operations. The Ashland County Highway Department produced sand and gravel for its own use.

TABLE 12.—Value of mineral production in Ohio, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value [2]
Adams	$628,951	$553,314	Stone.
Allen	953,636	855,797	Stone, sand and gravel.
Ashland	(3)	(3)	Sand and gravel.
Ashtabula	115,834	155,455	Do.
Athens	235,725	2,840,542	Coal, stone, sand and gravel.
Auglaize	400,607	424,477	Sand and gravel, stone.
Belmont	59,934	23,845,462	Coal, stone, clays.
Brown	31,214	68,479	Stone, sand and gravel.
Butler	884,126	989,591	Sand and gravel, stone.
Carroll	428,740	1,555,396	Coal, clays, sand and gravel, stone.
Champaign	(3)	(3)	Stone, sand and gravel.
Clark	613,604	591,111	Sand and gravel, lime, stone.
Clermont	(3)	(3)	Sand and gravel.
Clinton	(3)	(3)	Stone, sand and gravel.
Columbiana	706,821	6,001,237	Coal, clays, sand and gravel.
Coshocton	355,986	3,511,294	Coal, sand and gravel, stone.
Crawford	(3)	(3)	Stone, sand and gravel.
Cuyahoga	1,207,926	1,702,493	Sand and gravel, clays.
Darke	258,814	1,276,222	Do.
Delaware	918,562	1,061,881	Stone, lime, clays.
Erie	4,210,437	4,859,124	Cement, stone, sand and gravel.
Fairfield	167,141	150,697	Sand and gravel.
Fayette	937,087	728,378	Stone.
Franklin	6,273,238	5,315,864	Stone, sand and gravel, lime, clays.
Gallia	(3)	(3)	Coal, sand and gravel.
Geauga	648,509	594,350	Sand and gravel.
Greene	11,052,380	11,462,244	Cement, sand and gravel.
Guernsey	(3)	(3)	Coal, stone.
Hamilton	3,932,426	3,503,605	Sand and gravel, stone.
Hancock	583,066	649,527	Stone, clays, sand and gravel.
Hardin	500,263	(3)	Stone, sand and gravel.
Harrison	314,070	24,068,704	Coal, stone, clays.
Henry	(3)	(3)	Sand and gravel, clays.
Highland	441,892	434,552	Stone, clays, sand and gravel.
Hocking	250,614	1,236,571	Clays, coal, sand and gravel.
Holmes	1,334,037	1,531,500	Stone, clays, sand and gravel, coal.
Huron	168,784	221,945	Sand and gravel, clays.
Jackson	334,258	2,351,128	Coal, clays.
Jefferson	718,033	17,901,267	Coal, clays, sand and gravel.
Knox	967,951	681,092	Sand and gravel.
Lake	4,964,049	8,501,280	Salt, cement, sand and gravel, clays.
Lawrence	5,986,579	7,130,381	Cement, coal, clays, stone, sand and gravel.
Licking	392,966	469,187	Sand and gravel, clays.
Logan	225,959	199,578	Stone, sand and gravel.
Lorain	3,571,189	3,312,739	Stone, sand and gravel, grindstones.
Lucas	4,515,404	5,709,701	Cement, stone, sand and gravel.
Madison	(3)	(3)	Sand and gravel, clays.
Mahoning	3,417,569	5,451,454	Coal, stone, clays, peat, sand and gravel.
Marion	(3)	(3)	Stone, sand and gravel, clays.
Medina	(3)	(3)	Sand and gravel. clays.
Meigs	(3)	(3)	Coal, sand and gravel, salt, natural salines.
Mercer	(3)	(3)	Stone.
Miami	(3)	1,482,094	Stone, sand and gravel.
Monroe	(3)	(3)	Do.
Montgomery	1,633,347	1,998,748	Sand and gravel, stone.
Morgan	(3)	(3)	Coal, sand and gravel, stone.
Morrow	(3)	(3)	Sand and gravel.
Muskingum	5,412,893	8,571,264	Cement, coal, sand and gravel, stone, clays.
Noble	(3)	(3)	Coal, stone, clays, sand and gravel.
Ottawa	11,323,349	12,518,656	Lime, stone, gypsum.
Paulding	431,439	(3)	Stone, clays.
Perry	(3)	8,761,380	Coal, stone, clays, sand and gravel.
Pickaway	(3)	(3)	Sand and gravel.
Pike	592,192	1,199,839	Do.
Portage	2,441,643	3,032,382	Sand and gravel, stone, coal, clays, peat.
Preble	611,597	528,968	Lime, sand and gravel, stone.

See footnotes at end of table.

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TABLE 12.—Value of mineral production in Ohio, 1953–54, by counties [1]—Continued

County	1953	1954	Minerals produced in 1954 in order of value [2]
Putnam	$423,322	$368,895	Stone, clays.
Richland	(3)	(3)	Sand and gravel, clays, peat.
Ross	813,179	1,090,979	Sand and gravel, stone.
Sandusky	15,868,145	13,890,751	Lime, stone, sand and gravel.
Scioto	1,942,143	1,772,564	Stone, clays.
Seneca	10,486,892	8,667,413	Lime, stone, clays.
Shelby	251,654	(3)	Sand and gravel.
Stark	5,183,264	8,684,006	Cement, coal, clays, sand and gravel, peat.
Summit	9,971,134	10,114,435	Salt, lime, sand and gravel, stone, peat, clays.
Trumbull	(3)	(3)	Sand and gravel.
Tuscarawas	2,355,284	11,205,823	Coal, clays, sand and gravel.
Union	(3)	(3)	Stone, sand and gravel.
Van Wert	292,717	298,692	Stone, clays.
Vinton	197,050	951,644	Coal, clays, stone.
Warren	380,493	367,798	Sand and gravel.
Washington	346,475	498,546	Coal, grindstones, sand and gravel, clays.
Wayne	2,160,218	2,525,044	Salt, coal, sand and gravel, clays.
Williams	87,104	280,537	Sand and gravel, clays.
Wood	1,177,433	1,341,315	Lime, stone, clays.
Wyandot	(3)	(3)	Stone, lime, peat, sand and gravel, clays.
Total	138,091,348	252,049,392	
Total fuels	149,519,408	16,821,000	
Undistributed	14,631,412	24,788,689	
Grand total	302,242,000	293,659,000	

[1] Defiance and Fulton Counties not listed; no production reported.
[2] Fuels, including natural gas, natural-gas liquids, and petroleum, not listed by counties, as data are not available; included in total value.
[3] Value included with "Undistributed," which also includes peat (1953), sand and gravel not listed by county (1953), recovered elemental sulfur, and natural gasoline.

Ashtabula.—Sand and gravel was produced by N. J. Pinney Co., Kingsville; A. C. Meade Construction Co., Inc., Lakeville; Northeast Materials, Inc., Kingsville; Melvin Miller for Carter Sand & Gravel Co., Ashtabula; and Peerless Mineral Products Co., Conneaut. The product was used primarily for building and paving purposes, although fire and molding sands also were produced.

Athens.—Bituminous coal, crushed limestone, and sand and gravel, in order of decreasing value, were produced in 1954. Except for Gem Coal Co. mine, Nelsonville, which produced over half of the county total, the mines were small. The major ones included Leo P. Oskey, Glouster; Sebring Coal Co., Alliance; and White Coal Co. and Valley No. 6 Coal Co., Inc., both of New Plymouth.

Crushed limestone was produced by Dickson Bros. and Diamond Stone Quarries, Inc., both of Albany, for use as concrete aggregate and roadstone. Sand and gravel for building and paving purposes was mined by Athens Building Material Co., Athens, and John Slater & Son, The Plains.

Auglaize.—Sand and gravel and limestone were mined in 1954. Producers of sand and gravel were Wapak Sand & Gravel Co., Western Ohio Stone Co., Quality Sand & Gravel Co., and Auglaize Sand & Gravel Co., all of Wapakoneta. The product was used primarily as building and paving material and a small tonnage as filter sand. National Lime & Stone Co., at its Buckland quarry near Wapakoneta, produced crushed limestone for road-making material and agricultural purposes.

Belmont.—Belmont County in 1954 dropped to second place as a coal producer, being replaced by Harrison County. About four-fifths of the production came from underground mines and the remainder

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from strip operations. The major producers included Powhatan Mining Co., Powhatan Nos. 1 and 2 mines; Youghiogheny & Ohio Coal Co., Dorothy and Florence mines; Saginaw Dock & Terminal Co., No. 1 mine; Lorain Coal & Dock Co., Blaine and Stanley mines; United States Coal Co., Midland mine; David Z. Norton Coal Co., Nos. 2 and 3 mines; and Hanna Coal Co., Division of Pittsburgh Consolidation Coal Co.

Crushed limestone was produced by George & C. H. McCort, Malaga, and Somerton Crushing Co., Somerton, for roadmaking material, agricultural purposes, and riprap.

Standard Stone & Brick Co., Bellaire, produced shale for manufacturing brick.

Brown.—Howard S. Watson, Georgetown, produced crushed limestone for agricultural purposes and concrete aggregate in 1954. The Brown County Highway Department produced paving gravel for its own use.

Butler.—There were nine active sand and gravel producers in 1954. The major ones were American Materials Corp., and Hamilton Gravel Co., both of Hamilton; Middletown Sand & Gravel Co., and Moorman Sand & Gravel Corp., both of Middletown; North Cincinnati Sand & Gravel Co., Hamilton; and Merkel Gravel Co., Oxford. The entire county output was utilized for building and paving purposes, except for small tonnages for railroad ballast and other uses. North Cincinnati Sand & Gravel Co., produced crushed limestone for concrete aggregate from an open quarry near Hamilton.

Carroll.—Bituminous coal, clays, sand and gravel, and dimension sandstone were produced in 1954. Most of the coal production was mined from strip pits. The major producers were James Bros. Coal Co., James strip mine; John M. Hirst Co., Sterling underground mine; W. J. Moore & Son Coal Co., strip mine; and McCleery Mining Co., No. 1 strip mine.

Fire and miscellaneous clays, used entirely in manufacturing heavy clay products (building brick, draintile, sewer pipe, etc.), were produced by Whitacre-Greer Fireproofing Co., Magnolia; Natco Corp., Magnolia; Metropolitan Brick, Inc., Minerva (on the Stark County line); James Bros. Coal Co. and Hickory Clay Products Co., both of Mineral City; and Robinson Clay Products Co., Malvern, all from open-pit mines.

Molding sand was mined by Mineral City Sand Co. Rainbow Stone Co. took over operation of the sandstone quarry of Ten Colors Stone Co., Sherrodsville, and produced a multicolored dimension stone for building homes and fireplaces.

Champaign.—Crushed limestone and sand and gravel were produced by American Aggregates Corp., Urbana, for concrete aggregate, paving, and railroad ballast. Walter R. Dorsey of West Liberty also produced paving gravel from a bank operation.

Clark.—Moores Lime Co., Springfield, produced crushed limestone from an open quarry at Durbin for use as blast-furnace flux, concrete aggregate, road material, fertilizer filler, and agricultural stone. The company also calcined part of its production for manufacturing lime for masons, agricultural purposes, and chemical and industrial uses.

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Sand and gravel for building and paving purposes were produced by Eagle City Sand & Gravel Co. and Estey Sand & Gravel Co., both of Springfield; Enon Washed Sand & Gravel Co., Enon; Springfield Gravel & Excavating Co., Springfield; Omer S. Porter and New Carlisle Sand & Gravel Co., both of New Carlisle; and M. Edemiller, Springfield.

Clermont.—Sand and gravel and crushed boulders were produced by Ohio Gravel Co., from a pit near Miamiville, for building and paving uses and railroad ballast.

Clinton.—Melvin Stone Co. produced limestone from a quarry near Melvin for riprap, concrete aggregate, road material, agricultural purposes, and metallurgical uses. This company also produced sand and gravel, from a pit 7 miles east of Wilmington, for building and paving purposes.

Columbiana.—Bituminous coal, clays, and sand and gravel were mined in 1954. Over nine-tenths of the coal production was from strip mines. Underground operations were small and for the most part nonmechanized. The leading coal producers included Buckeye Coal Mining Co., McCombs strip and auger operations; A. B. C. Mining Co., A. B. C. strip; Ferris Coal Co. strip mine; Industrial Mining & Engineering Co. strip; Sunnyside Coal Mining Co., Achor and Unity strip pits; R. & R. Coal Co., Inc., Fowler McKenzie and Cream Ridge strips; Torrence Coal Co. strip operation; and Burn Rite Coal Co., Cunningham and Morris strip operations.

Fire clay, used primarily in manufacturing refractories and heavy clay products, and miscellaneous clay, used mostly for heavy clay products, were mined in Columbiana County. McLain Fire Brick Co., Division of H. K. Porter Co., Inc., was the leading producer, with three underground pits near Wellsville for manufacturing firebrick. Other producers included West Darlington Clay Co. and Natco Corp., both of Negley; Summitville Face Brick Co., Summitville; and L. L. Adams Clay Co. and Kay Mining Co., both of Lisbon.

Sand and gravel for building and paving purposes was produced primarily by Iron City Sand-Gravel Corp., which operated a dredge on the Ohio River. Morgan Sand Bank also operated an open-pit operation near Leetonia.

Coshocton.—Bituminous coal, produced mainly from strip mines, sand and gravel, and sandstone were mined in 1954. The leading coal producers in the county, which ranked eleventh in the State, were Willowbrook Coal Co., Fresno Coal Co., Blue Crystal Mines, Inc., Hutt Coal Co., Freeport Gas Coal Co., and Adams Mills Coal Co.

Sand and gravel was produced from nine quarries: B. W. Boyd & Son and George E. Miller, both near Coshocton; W. P. McCarren Co., Canal Lewisville and Walhonding plants; Shady Bend Sand & Gravel Co., Newcomerstown; and Fletcher Pew, Warsaw. The bulk of the product was consumed for structural and paving uses, although molding sand was produced by Ayers Mineral Co., Warsaw; and E. F. & James A. Meyer, Layland. Sawed sandstone was produced by Pearl Sandstone Co. from an open quarry near Fresno.

Crawford.—Crushed limestone for concrete aggregate, railroad ballast, and agricultural purposes was produced by National Lime & Stone Co., Spore quarry, near Bucyrus. Sand and gravel for paving

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purposes was mined from a bank and wet-pit operation near Galion by the Galion Gravel Co.

Cuyahoga.—Sand and gravel was produced at 11 operations in 1954; the county ranked sixth in the State. The major producers were Charles Loparo Sand & Gravel Co., Cuyahoga Heights; Shaker Sand & Gravel Co., near Cleveland; Newburgh Sand & Gravel Co., Garfield Heights; Canal Sand & Gravel Co., near Cleveland; Testa Bros., Inc., Glenwillow; and Kaiser Nelson Co., near Cleveland. The product, obtained primarily from bank operations, was used almost entirely for building and paving purposes. Cuyahoga was replaced by Tuscarawas as the leading producer of miscellaneous clay. The producers in Cuyahoga County were Cleveland Builders Supply Co., Warner and Pearl open-pit mines near Cleveland; Hydraulic Press Brick Co., South Park; Collinwood Shale Brick & Supply Co., near Cleveland; and Berea Tile Co., Berea. All produced from open-pit mines. The production was utilized for manufacturing heavy clay products, with the exception of that from Hydraulic Press Brick Co., used as lightweight aggregate. Expanded perlite, for use as plaster and concrete aggregate, was produced by Cleveland Gypsum Co. from material from southwest United States.

Darke.—American Aggregates Corp., from wet-pit operations near Greenville and Fort Jefferson, produced the major portion of sand and gravel in Darke County in 1954 primarily for paving purposes, plus small tonnages for railroad ballast. Other producers were C. F. Poeppelman, Versailles; Aubrey Shields, Greenville; Slagle Gravel Plant, Greenville; Hollinger Gravel Co., New Madison; and L. C. Ilgen, Versailles. The only producer of clay was Darke County Tile Co., which mined miscellaneous clay from an open pit near Greenville for use in manufacturing drain tile and brick.

Delaware.—Crushed and dimension limestone, lime, and clay were produced in 1954. Crushed limestone producers included Scioto Lime & Stone Co., Delaware; Shawnee Stone Co., Rathbone; Owens Stone Co., Ostrander; and Penry Stone Co., Radnor. The product, obtained entirely from open-quarry operations, was used for concrete aggregate and roadstone, agricultural purposes, riprap, and in manufacturing lime. Dimension limestone for bridges was quarried by Jones Bros. from an open pit near Delaware. Delaware Clay Co., Westerville, and the Galena Shale Tile & Brick Co., Galena, mined miscellaneous clay for use in manufacturing heavy clay products from open-pit operations. Scioto Lime & Stone Co., Delaware, produced lime for chemical, agricultural, and building purposes.

Erie.—Cement was manufactured at Baybridge by Medusa Portland Cement Co. in 1954. Crushed limestone, for use as concrete aggregate, railroad ballast, agricultural purposes, and as riprap, was produced by Wagner Quarries Co., from an open quarry near Sandusky and by Castalia Quarries Co., Castalia. Molding-and-engine sand was mined by Kenner Sand & Clay Co., Huron, and A. Bachman, Inc., Shinrock.

Fairfield.—Sand and gravel, the only mineral produced in Fairfield County in 1954, was mined by F. H. Brewer Co., Sargent Gravel Co., and Homer Taylor & Son, all of Lancaster, H. N. Rose, for Industrial Minerals Co., and Bushcreek Sand & Gravel Co., both of Bremen, primarily for building and paving but some for molding purposes.

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Fayette.—Crushed limestone was quarried by Blue Rock, Inc., near Greenfield, (Highland County) and Fayette Limestone, Inc., and Sugar Creek Stone Co., both of Washington Court House. Production was utilized as concrete aggregate and roadmaking material and for agricultural purposes and railroad ballast.

Franklin.—Franklin County was the third ranking producer of sand and gravel in the State in 1954. In addition, crushed limestone, lime, and clays were mined. Leading sand and gravel producers were American Aggregates Corp., Jackson Pike Sand & Gravel Co., Arrow Sand & Gravel Co., a subsidiary of Marble Cliff Quarries Co., all of Columbus; and Mason Sand & Gravel Co., Reese Station. Production was utilized primarily for building and paving purposes and as railroad ballast. Marble Cliff Quarries Co., Columbus, produced crushed limestone for blast-furnace flux, concrete aggregate, roadmaking material, agricultural purposes, railroad ballast, asphalt filler, and lime manufacturing. Miscellaneous clay was mined by the Claycraft Co. and Columbus Clay Manufacturing Co., both of Blacklick, from open-pit mines for manufacturing heavy clay products.

Gallia.—Bituminous coal, mined primarily from strip and auger operations, and sand and gravel were produced in 1954. The leading coal producer, with more than half of the county total, was Ohio River Collieries strip mine. Other producers included Middleport Coal Co., Gallia Coal Co., Fitch Coal Co., Carson Coal Co., Peacock Coal Mining Co., and Waterloo Coal Co., Inc. Sand and gravel was mined by Epling Sand & Gravel Co., Gallipolis, for use in building and paving, plus a small tonnage for glass sand. Keener Sand & Clay Co., also of Gallipolis, produced molding sand in 1954.

Geauga.—R. W. Sidley, Inc., Thompson, produced the bulk of the county sand and gravel in 1954 for building and paving, refractory, and metallurgical purposes, and as fire or furnace sand. Other producers included Jefferson Materials Corp., Burton, and Sperry Road Sand & Gravel, Chesterland.

Greene.—Greene County remained the leading cement producer in the State in 1954 as Southwestern Portland Cement Co. and Universal Atlas Cement Co. plants near Fairborn continued in operation. Southwestern Portland Cement Co. also operated a limestone quarry near Fairborn and produced crushed limestone for use in its cement plant. Sand and gravel were mined by Greene Township Gravel Co., Cedarville; Charles McNamee, Fairborn; Phillips Sand & Gravel Co., and the Kemp Road Gravel Co., both in Beavercreek Township near Dayton; Jesse Barnett Sand & Gravel Co., Spring Valley; and Whitacre & Roberts, Xenia.

Guernsey.—Bituminous coal, mined primarily from strip and auger operations, and crushed limestone were produced in 1954. Virginia Mining Co. produced over half of the county coal total from a strip and auger mine. Other producers included C. V. & W. Coal Co., Inc., Byesville Coal Co., Hamilton Trennor Coal Co., and Rome Coal Co. Crushed limestone was produced by John Gress from an open quarry near New Concord on the Muskingum County line.

Hamilton.—Hamilton County continued in 1954 to be the largest sand-and-gravel producer in the State. The primary uses were for building and paving purposes, but an output of gravel for railroad ballast and other uses was reported. Of the 10 active pits, 5 were

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operated by Ohio Gravel Co., with plants at Camp Dennison, Cincinnati, Hooven, Newtown, and Miamitown. Other major producers were Willey Ruckstuhl Co., Cincinnati, and George L. Rack and H. Lynn Barber, also of Cincinnati. Ohio Gravel Co. also produced agricultural limestone from quarries near Camp Dennison, Miamitown, and Newtown. Indoken Perlite Co. produced expanded perlite again in 1954.

Hancock.—Crushed limestone, the most important commodity in the State, was produced by the National Lime & Stone Co. and Tarbox McCall Stone Co., both of Findlay, and Pifer Stone Co., Williamstown, for concrete aggregate, roadmaking material, railroad ballast, and agricultural purposes. Hancock Brick & Tile Co., Findlay, produced miscellaneous clay from an open-pit mine for manufacturing heavy clay products. Sand and gravel was mined by Hobbs Bros. Sand & Gravel Co., Findlay.

Hardin.—Crushed limestone for metallurgical purposes, concrete aggregate, railroad ballast, agricultural purposes, and riprap was produced by Herzog Lime & Stone Co., Forest and Hardin Quarry Co., Dunkirk, from open-quarry operations. A small tonnage of sand and gravel was produced by Bells Sand & Gravel Co., Belle Center.

Harrison.—Harrison County ranked first in the State in coal production in 1954. Strip production accounted for more than four-fifths of the county total. By far, the major producer was Hanna Coal Co., Division of Pittsburgh Consolidated Coal Co. Other producers included Cadiz Mining Co., Youghiogheny & Ohio Coal Co., R. & F. Coal Co., and Powhatan Mining Co. This group of mines produced over 95 percent of the county total. Hanna Coal Co. also produced crushed limestone from an open quarry near Short Creek for concrete aggregate, roadmaking materials, and agricultural purposes. Freeport Quarries, Inc., produced dimension sandstone from an open quarry near Freeport. Bowerston Shale Co., Bowerston, was the sole producer of clay.

Henry.—Sand and gravel for building and paving purposes was produced by Napoleon Sand & Gravel Co. and Arthur Williams, both of Napoleon. Miscellaneous clay was produced by Napoleon Brick & Tile Works, Napoleon; and August Honeck & Son, Malinta, for use in manufacturing heavy clay products.

Highland.—Crushed limestone was produced by New York Coal Co., Hillsboro; Ohio Asphaltic Limestone Co., Inc., New Vienna, on the Clinton County line; and Clay Wilcox Quarry, Marshall. The output was used for roadmaking material and agricultural purposes. Sand and gravel was produced by Uhrig & Collins at Hillsboro. The sole producer of clay was Mowrystown Brick & Tile Co., Mowrystown.

Hocking.—Although only two companies reported the production of fire clay in Hocking County, the county ranked third in 1954. Natco Corp. was the leading producer, with an open-pit and underground operation near Haydenville. During the year, Natco Corp. took over operation of Hocking Valley Brick Co., Nelsonville. General Hocking Brick Co. was the other fire-clay producer in the county. The entire production was used in manufacturing heavy clay products. Sand and gravel was produced by F. H. Brewer Co., Enterprise; and Hocking Valley Sand & Gravel Co., Logan.

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Holmes.—The quarrying of dimension sandstone was the most important industry in Holmes County in 1954. Sawed and dressed stone for architectural work was produced by Briar Hill Stone Co., Glenmont, and Nicholl Stone Co., Killbuck. Fire clay and miscellaneous clay were mined by General Clay Products Co., Baltic, and Holmes Clay Division, of Holmes Limestone Co., Berlin, for use in manufacturing heavy clay products and in foundries. Three reporting sand and gravel producers were Feikert Sand & Gravel, Holmesville; Bickel & Close Sand & Gravel Co., Millersburg; and F. E. Kaser, Holmesville. A small tonnage of bituminous coal was mined by Kuhn & Smith, Inc., from a strip mine; and Buffalo Hill Coal Co., from an underground operation.

Huron.—Shale for use in manufacturing draintile was produced from an open-pit mine near New London by E. Biglow Co. The major producer of sand and gravel was Huron Sand & Gravel Co., Norwalk. Other producers were Greenwich Sand & Gravel Co., Greenwich; Keener Sand & Clay, Havens; and Tesmer Sand Co., Norwalk. Molding and filter sands were produced for structural and paving uses.

Jackson.—Fire clay was the only type of clay produced in 1954. The bulk of the product of county mines was sold, which is unusual in the State, as most of the clay output is used by the producers. The major producer was Cedar Heights Clay Co., Oak Hill, which produced plastic fire clay, primarily for refractories. Other producers were Poetker & House, General Refractories Co., the Pyro Refractories Co., and Jefferson Clay Co., all near Oak Hill. Bituminous coal was produced in Jackson County primarily from strip mines. Broken Aro Coal Co. contributed most of the county output from its Broken Aro strip mine. Other producers included Collins & Walton Coal Co., J. & R. Coal Co., Kriebel Bros. Coal Co., Sharon Contractors, Inc., Reed Coal Co., and Waterloo Coal Co., Inc.

Jefferson.—Jefferson County ranked third in bituminous coal production in 1954. One-half of the output came from underground and one-half from strip and auger operations. Hanna Coal Co., Division of Pittsburgh Consolidation, was by far the major producer at the Piney Fork No. 1 and Dun Glen No. 11 underground operations. Other large producers included Powhatan Mining Co., Warner Collieries Co., Ohio Edison Co., Zinnox Coal Co., Inc., Polen Coal Mining Co., Teramana Bros. Coal Co., Tri-State Coal Co., Pier Coal Co., and Nuri Coal Co.

Sand and gravel was produced by Iron City Sand-Gravel Corp., from a dredge on the Ohio River, for building and paving uses. Brilliant Sand Co. recovered building sand from a bank operation at Brilliant.

Both fire and miscellaneous clays were produced, fire clay being more important. Kaul Clay Mfg. Co., the major producer, mined both fire and miscellaneous clays from an open pit and underground operation near Toronto, primarily for manufacturing heavy clay products. Other producers included McLain Fire Brick Co., Division H. K. Porter Co., Inc., and Frederick J. Dando Co., both of Irondale; Union Clay Mfg. Corp., Empire; Peerless Clay Corp., Toronto; and Toronto Fire Brick Co., Stratton. All of these companies operated underground mines. The output was utilized for manufacturing heavy clay products and refractories.

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Knox.—Sand and gravel was the only mineral produced in 1954. The leading producers were Killbuck Sand & Gravel Co., Brinkhaven; Fredericktown Sand & Gravel Co., Fredericktown; Millwood Sand Co., Howard; Goodwin Sand & Gravel Co., and J. Harry Gaughman, both of Mount Vernon; R. D. Malick & Son Gravel Co., Fredericktown; and Charles C. Engle, Gambier. Glass-and-molding sand was produced by the Millwood Sand Co. Production from the other companies was utilized primarily for building and paving purposes.

Lake.—Salt, cement, sand and gravel, and clays, in order of decreasing value, were produced in 1954. Diamond Alkali Co. produced brine for manufacturing chemicals from wells at Painesville; the company also reported producing refractory magnesia from raw dolomite. Standard Portland Cement Co. continued to operate a cement plant in Painesville in 1954. Sand and gravel was produced primarily for building and paving purposes. Kelley Island Co., the principal producer, operated a dredge near Grand River. Other producers were Leonard Granger, Mentor Township; Bil-More Excavating Co., Willoughby; W. W. Metcalf, Mentor; Erie Road Gravel, Willoughby; Bradshaw & Thorne, Willoughby; and Ruth K. Edwards, Mentor. Miscellaneous clay for manufacturing heavy clay products was mined by Euclid Shale Brick Co. from an open pit near Wickliffe.

Lawrence.—Alpha Portland Cement Co., Ironton, and Marquette Cement Mfg. Co., Superior, reported cement production in 1954. Both companies reported mining limestone, clay and shale, and sandstone for use in their cement plants. Southern Ohio Products Co. also produced crushed limestone from an open quarry near Ironton for agricultural purposes and roadstone. Fire clay, by far the more important commodity, and miscellaneous clay were mined; half of the total was sold, and half was used by the producer. The leading clay producers were Cambria Clay Products Co., Blackfork; Carlyle Tile Co., Inc., Ironton; International Minerals & Chemical Corp., Pedro; Harbison-Walker Refractories Co., Bear Run mine, and Jefferson Clay Co., Firebrick; Southern Ohio Products Co., Ironton; and Lawrence Clay Refractories Co., Pedro. The product was used primarily for refractories but also for manufacturing heavy clay products and high-grade tile. A small quantity of bituminous coal was mined, mostly from strip pits. The major producers were Buckeye Coal & Limestone Co., the Greasy Ridge Coal Co., Callicoat Coal Co., and Joe Addis & Son. George B. Wilson, Chesapeake, produced building sand and gravel from a bank operation.

Licking.—Sand and gravel, the most important mineral commodity in Licking County in 1954, was mined by Newark Sand & Gravel Co., Vanatta Gravel Co., and Dry Creek Crushed Gravel Co., all of Newark; E. H. Hammond, Granville; North Fork Gravel Co., Newark; Alexandria Sand & Gravel Co., Alexandria; and Paul Jones, Newark. Miscellaneous clay was produced by Bowerston Shale Co. from an open pit near Hanover.

Logan.—Stone and sand and gravel were mined in Logan County in 1954. Western Ohio Stone Co., Huntsville, and National Lime & Stone Co., East Liberty, operated open quarries and produced limestone for concrete aggregate, roadstone, and agricultural purposes. Sand and gravel was produced by Neers Engineering Laboratories

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from a bank operation near Bellefontaine and Moraine Sand & Gravel Co., West Liberty.

Lorain.—Dimension and crushed sandstone, sand and gravel, and grindstones were mined in Lorain County in 1954. The Cleveland Quarries Co. operated an open quarry near Amherst and produced architectural stone, curbing and flagging, and crushed and broken stone for riprap and silica brick. Nicholl Stone Co. reported an output of sawed sandstone from a quarry near Kipton and an output of grindstones. Kelley Island Co. and Lorain Elyria Sand Co. reported operating dredges in Lake Erie for sand recovery for use as fire and furnace sands and building and paving material. Lake Erie Sand & Transport Co. operated a dredge on the Maumee River and obtained building sand.

Lucas.—Medusa Portland Cement Co. continued operating its cement plant at Toledo in 1954. This company also reported mining limestone and clay for its use in manufacturing cement. The county ranked fifth in crushed-limestone output, compared with fourth in 1953. The leading producer was Maumee Stone Co., Maumee. The entire production from its open-quarry mine was used as concrete aggregate and road-making material. Other producers were Toledo Stone & Glass Sand Co., Sylvania, and France Stone Co. quarries, Waterville and Holland. Sand was produced by Lake Sand & Gravel Co., Toledo, and Vermilion Sand & Supply Co., Vermilion, for building purposes.

Madison.—Small quantities of sand and gravel and clays were mined in Madison County in 1954. West Jefferson Sand & Gravel Co., West Jefferson, was the only operator producing building and paving sand and gravel. The Madison Tile Co. operated an open-pit mine near London and produced surface clay for manufacturing draintile.

Mahoning.—Carbon Limestone Co., one of the principal crushed-limestone producers in the State, was the only company producing in Mahoning County in 1954. The output was utilized primarily as blast-furnace flux and for other metallurgical uses; additional uses were for concrete aggregate, agricultural purposes, coal-mine rock dusting, and miscellaneous purposes. American Fire Clay & Products Co. was the major fire-clay producer in the county; its output was used in foundries. Other clay producers were Pen-Hio Clay Co., Youngstown, and Alliance Clay Products Co., Alliance. A small quantity of peat was mined for use as a soil conditioner. The entire bituminous-coal output of the county was strip-mined. The major producer was Marshall Mining Co.; other large producers included East Fairfield Coal Co., Inc., Keller Mines, Inc., Lisbon Coal Co., Delauter Coal Co., Davis Coal Co., and Poland Coal Co. Garfield Sand & Gravel Co., Garfield, was the only producer of sand and gravel.

Marion.—National Lime & Stone Co., operator of an open quarry near Marion, was the major producer of crushed limestone in the county. Other producers were J. M. Hamilton & Sons Co., Marion, and Tri-County Limestone Co., La Rue. The output of the three companies was utilized for concrete aggregate and roadmaking material, agricultural purposes, and railroad ballast. Miscellaneous clay was mined by Marion Brick & Tile Corp., Iberia; and La Rue Tile Co., La Rue. Penry Stone Co., Garfield, was the only sand-and-gravel producer.

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Medina.—Quillan Bros. Construction Co., 2 miles southeast of Lodi, and E. H. Diebel, for Allied Supply Co., Medina, operated sand and gravel pits in Medina County in 1954. The Wadsworth Brick & Tile Co. operated an open-pit mine near Wadsworth and produced miscellaneous clay for manufacturing heavy clay products.

Meigs.—An output of bituminous coal, more than half of which was produced by auger mines, was reported in 1954. Swisher Coal Co., with both strip and auger operations, was the principal producer. Other large producers included Goeglein Coal Co., Branch C. Fleming, Adrienne Coal & Dock Co., Raymond Chuckler, Jan Mining Co., Ohio Auger Mining Co., and Yonker Coal, Inc. Salt production was reported by Pomeroy Salt Corp. and Excelsior Salt Works, Inc., both of Pomeroy. The output of both plants was evaporated by the open-pan method and utilized primarily by meatpackers, feed dealers, and water-softener manufacturers. Pomeroy Salt Corp. reported a production of natural salines (calcium chloride) at its Minersville plant from natural well brines. Tri-State Materials Corp., Pomeroy, reported production of paving sand and gravel.

Mercer.—Crushed limestone for concrete aggregate, roadmaking material, agricultural purposes, and riprap was produced from open-pit operations by John W. Karch Stone Co., Celina, and Rockford Stone Co., Rockford.

Miami.—Piqua Quarries of Armco Steel Corp. reported the operation of an open quarry near Piqua. The output was utilized primarily for metallurgical purposes; other uses were for concrete aggregate, roadmaking material, agricultural purposes, and as a whiting substance. The production of sand and gravel reported by Fenton Construction Co., Troy; Steiner's Sand & Gravel, Ludlow Falls; Estey Sand & Gravel Co., Troy; Vandalia Sand & Gravel Co., Tipp City; Lester Langston, Piqua; and B. & M. Sand & Gravel, was used entirely for building and paving purposes.

Monroe.—Production of crushed limestone for concrete aggregate and agricultural purposes was reported by Walter L. and Nora A. Christman, Seneca Township, and H. F. Zerger, Woodsfield. A small production of Government-and-contractor sand and gravel was reported by Max R. Farley, 10th District Engineer.

Montgomery.—Montgomery County ranked second in sand and gravel production in the State in 1954. Production was reported from 17 pits in 1954, compared with 9 in 1953. The largest was American Aggregates Co. wet pit near Dayton. Other important producers included Southern Hills Pit, Inc., Kettering; Central Sand & Gravel Co., Dayton; Miller Bros., Butler Township; Wysong Gravel Co., Trotwood; J. W. Thomas Gravel Co., Keystone Gravel Co., and Hurst Sand & Gravel Co., all of Dayton; Englewood Sand & Gravel Co., Englewood; Zimmerman Sand & Gravel Co., West Carrollton; M. G. Snyder Sons, Inc., Dayton; and Pyper Sand & Gravel, Kettering Village. The county output was utilized primarily for building and paving purposes. Laura Gravel-Stone Co.. Phillipsburg, reported production of crushed limestone for concrete aggregate, roadmaking material, metallurgical uses, and agricultural purposes.

Morgan.—Almost all the bituminous-coal production in Morgan County was from Central Ohio Coal Co. strip mine. Chesterhill Stone Co. reported operation of an open limestone quarry near

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Hackney; the output was utilized for concrete aggregate and road-making material. Stockport Sand & Gravel Co., and Douglas Ervin, both of Stockport, and Fred Price Contracting reported sand and gravel production in 1954.

Morrow.—Chesterville Sand & Gravel Co., Chesterville, produced sand and gravel from a dry pit in 1954 for building and paving purposes.

Muskingum.—Pittsburgh Plate Glass Co. produced cement at its East Fultonham plant, primarily from materials (limestone and shales) mined by company operations. Sidwell Bros. produced crushed limestone from an open quarry near Zanesville for use as concrete aggregate, roadmaking material, and agricultural purposes. Sand and gravel was produced by Muskingum River Gravel Co., Duncan Falls; Zanesville Gravel Co., Dresden; and Ayers Mineral Co., Zanesville, from dry pits for building and paving purposes. Ayers Mineral Co. output was utilized as molding sand.

Bituminous coal, more than four-fifths from strip operations, was also mined in the county. Most of the producers reported less than a 10,000-ton output, the principal producer was Central Ohio Coal Co. Others with a fair-size production were Ten X Coal Co., Bruns Coal Co., White Cottage Coal Co., Maple Hill Coal Co., Red Ember Coal Co., and Monroe Coal Co. The only producer of clay was Clyde Nelson, who operated an open-pit mine near Roseville and produced stoneware clay.

Noble.—Bituminous coal, clays, and stone were mined in Noble County in 1954. Commercial Fuel Co. and Electro Metallurgical Co., Division of Union Carbide & Carbon Corp., produced most of the county coal total. Other producers included Moscrip Mining Corp., Koontz Coal Co., Bruns Coal Co., and Belle Valley Coal Co. Crushed limestone was mined by James Merry from an open-pit mine near Caldwell for concrete aggregate and agricultural purposes. The only producer of clay was Ava Brick Co., Ava, which produced miscellaneous clay from an open-pit mine for manufacturing heavy clay products.

Ottawa.—Ottawa County in 1954 maintained first position among the limestone-producing counties in the State. Kelley Island Co., at its Marblehead and Clay Center quarries, produced the bulk of the county output. United States Gypsum Co. produced dolomite at the open quarry near Genoa. The county output was utilized primarily as blast-furnace flux, although considerable tonnage was used for concrete aggregate, roadmaking material, and agricultural purposes. These companies also calcined a considerable tonnage of crushed limestone in manufacturing building and agricultural lime, refractory material, and chemical and industrial limes. U. S. Gypsum Co. and Celotex Corp. continued gypsum operations at Gypsum and Port Clinton, respectively, in 1954.

Paulding.—Miscellaneous clay for heavy-clay-product manufacturing was produced by Haviland Clay Works Co. and Dangler Drain Tile Co., of Haviland and Paulding, respectively, from open-pit operations. Fire clay (red clay) was mined by Baughman Tile Mill, Paulding. Crushed limestone was produced by Consolidated Cement Corp. from an open quarry near Paulding for use in its cement plant. Auglaize

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Stone Co., Oakwood, produced crushed limestone for concrete aggregate, roadmaking material, and agricultural purposes.

Perry.—Perry County in 1954 dropped to fifth place in bituminous-coal production. The major portion of the output was yielded by county strip operations. The only underground mine with a large production was Jones Motor Sales, Inc., Misco mine. Most of the county strip production was mined by Sunnyhill Coal Co., Sunnyhill No. 8 mine. Other fairly large strip-mining companies include Sidwell Bros., J. T. Coal Co., Buckingham Coal Co., Sandra Coal Mining Co., Inc., Boyle Coal Co., and Star Mining Co.

Crushed sandstone was produced by Central Silica Co. at an open quarry near Glenford, for use in manufacturing pottery, porcelain, and tile, and for glass and foundrywork. Fire- and miscellaneous-clay production was reported by eight operators in 1954. The major producers were Claycraft Co., Shawnee; Logan Clay Products Co., located north of Logan; Belden Brick Co., Somerset; Ludowici-Celadon Co., New Lexington; Straitsville Brick Co., near Gore; on the Hocking County line; Rush Creek Clay Co. and Junction City Clay Co., of Junction City; and J. T. Coal Co., New Lexington. The only producer of sand and gravel was Industrial Minerals Co., Lancaster, which produced molding sand.

Pickaway.—Sturm & Dillard Co. continued to operate a dredge at Circleville and produced sand and gravel for paving purposes and railroad ballast.

Pike.—Sand and gravel was the only mineral commodity produced in Pike County in 1954. This production was relatively important, and the county ranked ninth among 70 sand- and gravel-producing counties in the State. Producers were Massac Materials Co., Piketon; Standard Slag Co., Jackson; Ralph Rogers & Co., Inc., Pee Pee Township; Ohio Mineral Co., Beaver; Sharon Silica Co., Jackson; and Scioto Valley Sand & Gravel Co., Jasper. Structural and paving uses were more important, although an output of molding and furnace sand was also reported.

Portage.—Sand and gravel, crushed sandstone, bituminous coal, clays, and peat, in order of decreasing value of output, were mined in Portage County in 1954. Sand and gravel output was reported by 14 producers in 1954, twice the number in the previous year, ranking the county fourth. The major producers were Hugo Sand Co., Kent; Industrial Silica Corp. pits at Garrettsville and Geauga Lake; Standard Slag Co., Mantua; Twin Lakes Sand, Inc., Kent; Ray S. Troyer, Shalersville Township; Evans R. Beck, Kent; Ray & Carl A. Munn, Ravenna; Brugman Sand & Gravel Co., Mantua; Stroup & McMackin, Mogadore; Karl Brugman, Ravenna; and G. H. Flesher, Kent. Most of the production was for building and paving purposes, but Industrial Silica Corp. also produced large tonnages of molding, polishing, engine, and filter sands. Plastic fire clay was mined by Universal Sewer Pipe Corp. from its pit near Palmyra. Crushed sandstone was produced by Harbison-Walker Refractories Co. from an open quarry near Nelson for manufacturing silica brick. The only producer of bituminous coal was Peterson Coal Co. at its Atwater strip mine. A small tonnage of peat was mined for soil-conditioning purposes.

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Preble.—Marble Cliff Quarries Co., the only producer of crushed limestone, operated an underground mine near Lewisburg in 1954. In addition to using the product in manufacturing lime at the company lime plant at Lewisburg, the product was utilized for agricultural purposes, concrete aggregate, and blast-furnace flux. The output of the lime plant was used primarily for chemical and industrial purposes. Sand and gravel was mined by White Gravel Co., Camden, and Blue Bank Gravel Co. and Steiner's Sand & Gravel, both of West Alexandria, for use as building and paving material.

Putnam.—Crushed-limestone production was reported by National Lime & Stone Co., Columbus Grove; Ottawa Stone Co. and Putnam Stone Co., both of Ottawa; and Schumacher Stone Co., Pandora. The product was utilized as concrete aggregate and railroad ballast and for agricultural purposes. Miscellaneous clay was produced by Glandorf Tile Co., Glandorf; Snyder Tile Co., Continental; Miller Bros. Clay Works, Ottoville; and Etter Tile & Coal Co., Dupont; all for manufacturing heavy clay products.

Richland.—Sand and gravel was produced by Harvey Fleck & Son, Lexington; Killbuck Sand & Gravel Co., Lucas; and Paul Farst, Butler, for structural and paving uses. Government-and-contractor sand and gravel also was mined. Building brick was produced by Richland Shale Brick Co. and Ohio Lumber & Face Brick Co., both of Mansfield, from miscellaneous clay mined at open-pit operations. Peat for soil-conditioning purposes was also mined in the county.

Ross.—Sand and gravel was the most important mineral commodity; Ross County ranked fifth in production among the 70 producing counties. Seven producers reported, including Central States Construction Co., Kinnikinnick; Basic Construction Materials Division, New York Coal Co., Chillicothe; Miami Gravel Co., Chillicothe; A & W Gravel Co., Richmon Dale; Brewer & Brewer Sons, Inc., Chillicothe; Paint Valley Sand & Gravel Co., Bainbridge; and Du Bois Sand Co., Chillicothe. The output was utilized primarily for building and paving purposes. Paint Valley Sand & Gravel Co. also produced crushed limestone for agricultural purposes.

Sandusky.—Sandusky County ranked first in the State in the production of lime and second in limestone. Seven lime plants operated during the year. These operators were Dolite Co., Gibsonburg; J. E. Baker Co., Millersville; Ohio Lime Co. and Standard Lime & Stone Co., both of Woodville; and Gibsonburg Lime Products Co., National Gypsum Co., and Kelley Island Co., all of Gibsonburg. The limestone in Sandusky County is characterized by a high content of magnesium; hence, a large tonnage of dead-burned dolomite was reported. In addition, building, agricultural, and chemical and industrial uses were reported. Dolomite limestone production was reported by the following companies: France Stone Co., near Bellevue, on the Huron County line, J. E. Baker Co., Millersville; Ohio Lime Co., and Standard Lime & Stone Co., Woodville, Gibsonburg Lime Products Co., National Gypsum Co., and Kelley Island Co., all of Gibsonburg; and Cottron Bros. Co., Fremont. It will be noted that many limestone producers are also leading lime producers, calcining limestone quarried at their own pits. Home Sand & Coal Co., Fremont, was the only producer of building sand in 1954.

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Scioto.—Dimension sandstone, mined by Waller Bros. Stone Co. and Taylor Stone Co., both of McDermott, was the most important mineral commodity in Scioto County in 1954. The output was utilized chiefly for sawed, dressed, rough, or cut architectural blocks, as well as curbing and flagging. Each company also reported an output of small tonnages of crushed and broken sandstone for refractory purposes and for use as riprap.

Flint and plastic fire-clay production was reported by 4 producers in 1954: International Minerals & Chemicals Corp., Lyra; Harbison-Walker Refractories Co., Scioto Furnace; Pyro Refractories Co., Wheelersburg; and Aetna Fire Brick Co., south of Oak Hill in Jackson County. Production was utilized in manufacturing fire brick and block and in foundries.

Seneca.—Basic Refractories, Inc., operated the largest lime-producing plant in Seneca County at Maple Grove. The output of this plant was used entirely to produce dead-burned dolomite, a refractory material. The company also operated a dolomite quarry at Maple Grove. The product was utilized as concrete aggregate and for agricultural uses and blast-furnace flux. Other dolomitic limestone producers were The France Co., Bloomville, and Northern Ohio Stone Co., Flat Rock, which also produced dimension limestone as a building stone.

Arnold Gerhardstein produced a miscellaneous red-surface clay from an open pit near Bloomville for manufacturing draintile.

Shelby.—The principal producer of sand and gravel, the only mineral mined in Shelby County in 1954, was Sidney Sand & Gravel Co., Sidney. Carl Tunks Gravel Co. was the only other producer. The output was utilized as building material.

Stark.—Cement, bituminous coal, sand and gravel, clay, crushed limestone, and peat were produced in Stark County in 1954. Diamond Portland Cement Co. produced cement at its Middlebranch plant, utilizing limestone and clays mined at company quarries. Bituminous coal was mined primarily from strip operations. The leading producers were Truck Coal Co., Tri Seam Mining, Inc., Magnolia Mining Co., Billman Coal Co., Weaver Coal Co., and Merrick Coal Co. An output of fire clay and miscellaneous clay was reported from 10 producers: They were Stark Ceramics, Inc., Alliance Clay Products Co., Alliance; Belden Brick Co., Waco; Metropolitan Brick, Inc., Canton; U. S. Quarry Tile Co., East Sparta; James & James Coal & Clay Co., N. Industry; and Natco Corp., East Canton.

Stark County ranked seventh among the sand and gravel-producing counties in the State. Production was reported from 11 pits. The major producers were Canton Slag Co. and Massillon Washed Gravel Co., both of Massillon; Ray Oster, United Sand & Gravel Co., and Diamond Washed Gravel Co., all of Canton; Uniontown Sand & Gravel Co., Uniontown; and Acme Sand & Gravel Co., Canton. Output was utilized as building and paving material. Peat was mined for soil-conditioning purposes.

Summit.—Summit County was the leading salt producer in the State again in 1954. Columbia Southern Chemical Corp., Barberton, and Diamond Crystal Salt Co., Akron, were the producers. The bulk of production from Columbia Southern was used in brine form in manufacturing chemicals and not in manufacturing salt. Part of the

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combined brine output was used for recovering evaporated salt by vacuum and open-pan methods. Columbia Southern also mined limestone near Barberton, at a depth of more than 2,200 feet, producing limestone primarily for chemical uses. A portion of the limestone was utilized by the company lime plant at Barberton to manufacture chemical lime. Production of sand and gravel was reported from 11 operators in 1954. The major producer was Rubber City Sand & Gravel Co., Akron. Other large producers included Botzum Bros. Co., Akron; J. P. Loomis Coal & Supply Co., Cuyahoga Falls; Twinsburg Silica Sand & Gravel Co., Twinsburg Township; C. A. Heyl, Barberton; Busson Bros., Copley; and Vanselaw and Busson Gravel Co., Bath Township. Miscellaneous clay for use in manufacturing heavy clay products was mined by the Camp Bros. Co. from an open pit near Mogadore. A considerable tonnage of peat was produced for mulch and soil-conditioning purposes. Pure red oxides were produced by Minnesota Mining & Mfg. Co.

Trumbull.—Sand and gravel was recovered by Kinsman Sand & Gravel Co. from a dry-pit operation near the village of Kinsman.

Tuscarawas.—Tuscarawas County ranked first in the production of fire clay, first in miscellaneous clay, and fourth in bituminous coal. Many companies reported production of bituminous coal, but most were small operations. Over half of the county total was recovered from strip and auger pits. The major producer was Columbia Southern Chemical Corp. Other large producers included Copperhead Coal Co., Paul Varga & Sons, Inc., Penn Ohio Coal Co., Eberhart Coal, Inc., Farbizo Coal Co., Black Bird Coal Mines, Robinson Clay Products Co., Huth Hill Coal Co., Universal Sewer Pipe Corp., Beaver Fork Coal Co., and Truck Coal Co.

The leading clay producers were Belden Brick Co., Port Washington and Sugarcreek; Davidson Mining, Inc., New Philadelphia; Fox Valley Mining Co., Gnadenhutten; Evans Pipe Co., Uhrichsville; Goshen Brick & Clay Co., Newcomerstown; Superior Clay Corp., Uhrichsville; Stone Creek Brick Co., Stone Creek; The Claycraft Co., Sugarcreek; Stillwater Clay Products Co., Uhrichsville; Fairfield Brick Co., Zoar; and Columbia Fire Brick Co., Strasburg.

Sand and gravel production was reported by nine companies: Tri-County Gravel Co., Sandyville; Spring Bros., Goshen Township; Edgar Spring, Inc., Midvale; Stocker Gravel Plant, Gnadenhutten; Clarence Hensel, New Philadelphia; Industrial Silica Corp., Dundee; McClean Bros., Tuscarawas; E. E. Murphy, Newcomerstown; and The Superior Sand Corp., New Cumberland.

Union.—The Union Limestone Co., Millcreek, and H. E. Rockhold & Sons, York Center, produced crushed limestone from open quarries for use as concrete aggregate and for agricultural purposes; they also produced a small amount of riprap. The only producer of sand and gravel was Clymer Materials Co., Milford Center, which produced building and paving material.

Van Wert.—Crushed limestone and dolomite were produced in Van Wert County in 1954 by Union Quarries Co., Van Wert; Delphos Quarries Co., near Delphos on the Allen County line; and The France Co., Middle Point. The output was used as concrete aggregate, roadmaking material, railroad ballast, for agricultural purposes,

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and as riprap. Small amounts of miscellaneous clay were mined by Weck tile mill, Van Wert, and Fred Minzing & Son, Delphos.

Vinton.—Bituminous coal, clay, and stone were mined in Vinton County in 1954. The bulk of the coal production was obtained from strip operations. By far, the major producer was Benedict, Inc. Other large producers included Clinton Coal Co., Power Coal Co., Todd Bros. Coal Co., Loper Coal Co., and Rupert & Davis Coal Co.

McArthur Stone & Coal Co. produced crushed limestone from an open quarry near McArthur for use as concrete aggregate and for agricultural purposes. Hope Fire Clay Co. mined fire clay from an underground operation near Zaleski for use in making fire brick and block. McArthur Brick Co. produced miscellaneous clay from an open-pit mine near McArthur for use in manufacturing heavy clay products.

Warren.—By far the major producer of sand and gravel, the only mineral commodity produced in Warren County in 1954, was the Morrow operation of Van Camp Sand & Gravel Co. Other producers included Armitage & Son, with operations at South Lebanon and Waynesville; Franklin Sand & Gravel Co. and Harold V. Marty, both of Franklin; and Vernon H. Michael, Loveland, on the Northern boundary of Clermont County. The output was utilized entirely for building and paving purposes.

Washington.—Bituminous coal, grindstones, sand and gravel, and clays were taken from operations in Washington County in 1954. Peaker Run Coal Co. was the larger of two active coal mines, Hunter Coal Co., being the other. Constitution Stone Co. and Hall Grindstone Co., Constitution, produced grindstones from an open quarry near Marietta. Sand and gravel was produced from the pits of 4 operators in 1954. Marietta Concrete Corp., Marietta, was the leading producer. Other producers included Briggs Gravel Co. and L. C. Riley, Marietta, and Belpre Sand & Gravel Co., Belpre. Marietta Concrete Corp. also produced miscellaneous clay for use as a lightweight aggregate.

Wayne.—The entire county output of bituminous coal was obtained from Mullet Coal & Clay Mines, Mount Eaton, from a strip and auger operation. Morton Salt Co. produced evaporated salt from artificial brines from wells near Rittman by the open- and vacuum-pan methods. Three operators reporting sand and gravel were W. A. Rupp Construction Co., Marshallville; P. D. Siebert, Wooster; and Charles Zollinger, Rittman. Miscellaneous clay was mined by Medal Brick & Tile Co., Wooster, and Orrville Tile Co., Orrville, for use in manufacturing heavy clay products.

Williams.—Tri-State Gravel Co., Pioneer, was the foremost producer of sand and gravel in Williams County in 1954. Other large producers were Northwest Materials Co., Inc., Pioneer, and Mason Sand & Gravel Co., Edon. Also reporting production were Vincent Wortkoetter, Montpelier; Easler Sand & Gravel Co., Edgerton; and Shaull Gravel Co., Montpelier. Miscellaneous clay was produced by Stryker Drain Tile Co., from an open-pit mine near Stryker, for manufacturing draintile.

Wood.—Limestone and dolomite were mined by National Gypsum Co., Luckey; Pugh Quarry Co., Custar; The France Stone Co., North Baltimore; Wood County Stone & Construction Co., Bowling Green;

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and O. F. Brough, West Millgrove. The product was utilized primarily as concrete aggregate and roadmaking material, although other important uses included agricultural purposes, metallurgical uses, riprap, and railroad ballast. National Gypsum Co., Luckey, calcined a portion of the dolomite mined at its quarry and produced building, chemical, and agricultural lime. Perrysburg Tile & Brick Co. mined surface clay near Perrysburg for manufacturing draintile.

Wyandot.—National Lime & Stone Co., Carey, and J. L. Foucht, Upper Sandusky, mined limestone and dolomite in 1954. The output was used as concrete aggregate, roadmaking material, and railroad ballast; for metallurgical, agricultural, and chemical purposes; and as rock dust for dusting coal mines. National Lime & Stone Co. also produced quick and hydrated lime from a plant near Carey for building, chemical, and agricultural purposes. Two producers reporting sand and gravel output were Wilson Sand Co. and Corfman Gravel Co., both of Upper Sandusky. The output was utilized primarily as building and paving material, although a small amount of filter sand was also produced. Claycraft Co. mined miscellaneous clay from an open pit near Upper Sandusky for manufacturing heavy clay products. Peat was mined for use as mulch and for other soil conditioning. Wyandot was the leading county for peat production.

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The Mineral Industry of Oklahoma

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Oklahoma Geological Survey.

By Peter Grandone [1] and William E. Ham [2]

TOTAL value of mineral production in Oklahoma was $650 million in 1954, 4 percent less than the record $679 million in 1953. Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available, and differences will be adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage. Production of 14 minerals and 5 mineral fuels was reported. Compared with other States, Oklahoma in 1954 was the second-ranking producer of LP-gases, third-ranking producer of natural gas, and fourth-ranking producer of crude oil, natural gasoline, and zinc. Appreciable quantities of cement, coal, gypsum, sand and gravel, and stone also were

TABLE 1.—Mineral production in Oklahoma, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	577,557	$637,082	452,050	$1,282,848
Coal	2,167,594	13,226,881	1,914,834	11,264,692
Lead (recoverable content of ores, etc.)	9,304	2,437,648	14,204	3,891,896
Natural gas—million cubic feet	599,955	41,397,000	616,355	43,145,000
Natural-gas liquids:				
Natural gasoline and cycle products—thousand gallons	433,650	28,066,000	478,590	24,332,000
LP-gases—do	414,036	14,886,000	453,810	13,506,000
Petroleum (crude)—thousand 42-gallon barrels	202,570	546,940,000	[2] 185,851	[2] 518,520,000
Sand and gravel	[3] 5,011,366	[3] 4,258,585	5,424,131	4,265,031
Stone	[3 4] 8,489,994	[3 4] 7,930,737	[5] 9,238,811	[5] 9,146,995
Zinc (recoverable content of ores, etc.)	33,413	7,684,990	43,171	9,324,936
Undistributed: Native asphalt, cement, gypsum, lime, pumicite, salt, ground sand and sandstone, stone (dimension limestone, 1954), sulfur, and tripoli.				
Excludes value of clays used for cement, 1953		[4] 11,538,234		12,584,340
Total Oklahoma		679,003,000		[6] 650,205,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Final figure. Supersedes figure given in commodity chapter.
[3] Revised figure.
[4] Excludes limestone for cement and lime.
[5] Excludes certain stone, value for which is included with "Undistributed."
[6] Total adjusted to avoid duplication in values of clays and stone.

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produced. The mineral fuels—petroleum, natural gas, natural-gas liquids, and coal—furnished 94 percent of the total value of Oklahoma mineral production; metallic and nonmetallic minerals were responsible for the remaining 6 percent. Crude oil was produced in 57 of the 77 counties; natural gas in 54 counties; nonmetals in 60 counties; and metals (lead and zinc) in 1 county. Oil and natural gas were produced in a wide belt extending from the northeastern part of the State to the southwestern and northwestern parts; nonmetallic mining was distributed widely over the northeast, north central, and central regions and in the Arbuckle and Wichita Mountain areas of the southern part. Metallic mining was limited to Ottawa County in the northeastern part.

CONSUMPTION AND MARKETS

Oklahoma mineral industries processed a significant part of their output into finished and semifinished products for in-State consumption and for out-of-State shipments. These industries included oil refineries; natural-gasoline and cycle plants stripping natural gas of condensible liquids; zinc smelters, reducing zinc concentrate mined in Oklahoma; brick, tile, pottery, glass, and cement plants using clays, shales, silica sand, and limestone of Oklahoma; and producers of building materials made of Oklahoma gypsum. Large quantities of oil and natural gas continued to be transmitted by pipelines to industrial sections of the Eastern States.

The State regulatory body under the Interstate Oil Compact reduced the allowable production of oil about 8 percent from the 1953 allowable to conform with reduced demand for petroleum in 1954.

TRENDS AND DEVELOPMENTS

Decreased demand for Oklahoma crude oil resulted in a lower allowable and reduced production. Proved recoverable reserves of crude oil, on the other hand, increased about 12 percent over the previous year, and exploratory drilling centered in the Panhandle area of the State. Carbon black from refinery waste gases was produced by the new $2,750,000 plant of Continental Blacks, Inc., Ponca City.

In refining petroleum, a notable trend developed toward producing more premium grade motor fuel and raising the octane rating of motor fuels even higher. The competitive race for upgrading motor fuels was evidenced by new installations or contracts for catalytic cracking units and catalytic reformers at refineries at Cyril, Duncan, Enid, Wynne Wood, and West Tulsa.

Custom Mills and Smelters.—Six custom mills treating lead-zinc ores (mined locally and from Kansas) were: Central and Bird Dog mills of the Eagle-Picher Co., Beck No. 1 mill of the Beck Mining Co., Lucky Jenny mill of the Harris Mining Co., Wade-Bea mill of the Silver Streak Mining Co., and Mission mill of the W. M. & W. Mining Co. Three mine mills treating lead-zinc ores from company mines only were: Barbara J., Rialto, and Lawyers of the American Zinc, Lead & Smelting Co.

Smelting companies operating three horizontal zinc-retort plants in Oklahoma in 1954 were: American Metals Co., Ltd., Blackwell, Kay

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County; National Zinc Co., Bartlesville, Washington County; and Eagle-Picher Co., Henryetta, Okmulgee County.

Mineral Brokers.—Several smelting companies maintained mineral brokers or ore buyers in the Tri-State district of Oklahoma, Kansas, and Southwest Missouri. No metal concentrates were stockpiled at the mines, because all production continued to be purchased f. o. b. mill by the brokers.

A Defense Minerals Exploration Administration (DMEA) contract with L. D. Uto and W. I. Knox for exploration of uranium in Pawnee County was in effect. An application for DMEA assistance by M. C. Scherer and Ashton Glassall for manganese exploration in Johnston County was pending.

EMPLOYMENT IN THE MINERAL INDUSTRIES

Employment.—Total employment in the Oklahoma mineral industries increased 4 percent to an alltime high of 50,000 from the previous year.

Employment figures in the Oklahoma 1953 chapter were procured from Bureau of Mines data and are not comparable with complete coverage of the mining industry as shown in table 2.

Accidents.—No major accident was reported in any mineral or mineral-fuel industry in Oklahoma in 1954. There were 2 fatal accidents in the oil and gas industry, compared with 12 in 1953.

Two fatal accidents were reported in lead-zinc mining, 1 in nonmetal mining, and none in coal mining as compared with 3, 1, and 2, respectively, in 1953.

Wages.—Wages [3] of mineral fuels and metallic workers increased in 1954 while wages of coal and nonmetal miners remained virtually unchanged from the previous year.

TABLE 2.—Employment in mineral industries, 1947–49 (average), and 1950–54 [1]

[In thousands]

	1947–49 (average)	1950	1951	1952	1953	1954
Oil and gas mining	36.8	38.6	40.6	42.5	44.7	46.5
Coal mining	2.2	2.0	1.8	1.5	1.5	1.3
Other mining	3.0	2.5	2.8	2.8	2.0	2.2
Total	42.0	43.1	45.2	46.8	48.2	50.0

[1] Oklahoma Employment Security Commission, Handbook of Employment Statistics of Oklahoma, 1939–55.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Oklahoma continued to be an important source of crude oil and natural gas in 1954 and remained a major producer of the refined products. Native asphalt and a substantial quantity of a low-ash bituminous coal also were produced.

[3] Oklahoma Employment Security Commission, Handbook of Employment Statistics, Oklahoma 1939–55: Oklahoma City, Okla., pp. 11–15.

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Asphalt (Native).—Output of native rock asphalt (bituminous limestone and bituminous sandstone) was reported from Murray County. Production in 1954 was 40 percent over the previous year.

Coal.—The 1954 output of coal in Oklahoma continued to decline for the sixth consecutive year, when 1.9 million tons valued at $11.3 million was reported. Compared with 1953, the drop was 12 percent in quantity and 15 percent in value. Production was reported from 56 producers in 14 counties. Haskell, Le Flore, Pittsburg, Okmulgee, and Rogers Counties were the five leading producers, each reporting over $1 million in value.

TABLE 3.—Coal production, 1945–49 (average) and 1950–54

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1945–49 (average)	3,092,192	$13,475,267	$4.36	1952	2,193,409	$12,687,855	$5.78
1950	2,678,581	14,567,000	5.44	1953	2,167,594	13,226,881	6.10
1951	2,223,229	13,873,000	6.24	1954	1,914,834	11,264,692	5.88

Natural Gas.—Oklahoma continued to rank third in the Nation as a producer of marketed natural gas increasing about 3 percent in quantity to 616,355 million cubic feet and about 4 percent in value to $43 million over that of 1953. In addition to the gas marketed, 106,119 million cubic feet was used for repressuring, and 190,526 million cubic feet was vented. Compared with 1953, loss due to venting and wasting was reduced slightly by the increased use for repressuring. Production of natural gas was reported from 54 counties, the 5 leading producers being Texas, Garvin, Caddo, Oklahoma, and Grady, in the order named.

Although growth of the natural-gas industry was hindered temporarily in 1954 by the Federal Power Commission's apparent authority over certain phases of the industry, a shift from exploratory drilling to proved-field drilling in Oklahoma resulted in no change in the total completions of gas wells. Of the 859 exploratory wells (oil and gas) drilled in 1954, 25 (10 less than in 1953) were gas completions; of the 7,927 proved-field wells drilled, 358 (10 more than in 1953) were gas completions.

Estimated recoverable reserves of natural gas increased about 1 percent in 1954 to 12,396,148 million cubic feet from 1953 estimates.[4]

TABLE 4.—Marketed production of natural gas, 1945–49 (average) and 1950–54 [1]

Year	Million cubic feet	Value	Value per thousand cubic feet (mills)	Year	Million cubic feet	Value	Value per thousand cubic feet (mills)
1945–49 (average)	414,662	$17,060,000	41	1952	554,033	$29,918,000	54
1950	482,360	23,636,000	49	1953	599,955	41,397,000	69
1951	538,756	28,554,000	53	1954	616,355	43,145,000	70

[1] Comprises gas either sold or consumed by producers including losses in transmission, amounts added to storage, and increases in gas pipelines.

[4] American Gas Association and American Petroleum Institute, Proved Reserves of Crude Oil, Natural-Gas Liquids, and Natural Gas, Dec. 31, 1954: Vol. 9, 18 pp.

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TABLE 5.—Gross withdrawals and disposition of natural gas in Oklahoma, 1950–54, million cubic feet

Year	Withdrawals [1]			Disposition		
	From gas wells	From oil wells	Total	Marketed production [2]	Repressuring	Vented and wasted [3]
1950	378,510	280,330	658,840	482,360	29,333	147,147
1951	420,000	338,000	758,000	538,756	57,119	162,125
1952	420,000	404,100	824,100	554,C33	80,109	189,958
1953	460,000	425,000	885,000	599,955	92,136	192,909
1954	503,000	410,000	913,000	616,355	106,119	190,526

[1] Marketed production plus quantities used in repressuring, vented, and wasted.
[2] Comprises gas sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas in pipelines.
[3] Partly estimated. Includes direct waste on producing properties and residue blown to air.

The most significant gas discoveries of the year were made in the Hugoton Embayment of the Oklahoma Panhandle. Drilling in Texas County resulted in the first production of gas from the Topeka limestone in the West Eva pool; moreover, the most prolific gas well discovered in the Panhandle was completed in the Morrow sandstone of the southeast Camrick gas area. Other important exploratory gas wells were opened in Beckham and Cimarron Counties.

Oklahoma Natural Gas Co. completed the enlargement of its gas-dehydration plant at the Depew underground gas-storage station near Depew, Creek County, Okla. The plant capacity was increased to 800,000 thousand cubic feet of gas daily at a pressure of 800 p. s. i.

Natural-Gas Liquids.—Production of natural-gas liquids (by a total of 61 natural gasoline plants and 2 cycling plants) in Oklahoma increased 10 percent to 932 million gallons in 1954 while the value declined 12 percent to $37.8 million from 1953. This followed a price decline for the second consecutive year as gasoline stocks continued to increase. Production of natural gasoline and cycle products increased 10 percent in quantity and dropped 13 percent in value; LP-gases increased 10 percent in quantity and dropped 9 percent in value. Proved reserves of natural-gas liquids in Oklahoma in 1954 were estimated at 333.9 million barrels,[5] 10 percent over 1953 estimates.

TABLE 6.—Natural-gas liquids produced, 1945–49 (average) and 1950–54

Year	Natural gasoline and cycle products		LP-gases		Total	
	Thousand gallons	Value	Thousand gallons	Value	Thousand gallons	Value
1945–49 (average)	281,994	$18,665,000	172,310	$6,260,000	454,304	$24,925,000
1950	335,160	21,579,000	283,626	8,393,000	618,786	29,972,000
1951	397,236	27,498,000	339,528	12,436,000	736,764	39,934,000
1952	405,720	29,459,000	376,026	14,090,000	781,746	43,549,000
1953	433,650	28,066,000	414,036	14,886,000	847,686	42,952,000
1954	478,590	24,332,000	453,810	13,506,000	932,400	37,838,000

[5] Work cited in footnote 4.

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TABLE 7.—Production of natural-gas liquids in 1954, by type of product

Product:	*Thousand gallons*	*Value*
Natural gasoline	474, 390	$23, 945, 000
LP-gases	453, 810	13, 506, 000
Finished gasoline and naphtha	2, 940	300, 000
Other products [1]	1, 260	87, 000
Total	932, 400	37, 838, 000

[1] Includes condensate, kerosine, distillate fuel, etc.

Sterling Oil of Oklahoma, Inc., placed a new $500,000 gasoline plant in operation near Garber, Garfield County. This plant with 14,000-million-cubic-foot daily capacity, processed gas from the East Spring Valley field. Shell Oil Co. plant at Elk City, Beckham County, was enlarged to double its gas-processing capacity.

Petroleum.—Oklahoma remained the Nation's fourth-ranking producer of crude oil in 1954 with an output of 185.9 million barrels valued at $518.5 million, a decline of 8 percent in quantity and 5 percent in value from 1953. Crude oil was produced in 57 counties; the leading 5 producers were Stephens, Carter, Garvin, Osage, and Seminole Counties.

In 1954, the State had 65,390 producing oil wells, compared with 63,400 in 1953. The daily average output per well declined to 7.9 barrels from 8.8 barrels in 1953, owing partly to reduction in prorated allowables. The increased number of "stripper" wells contributed to the lower average output per well. However, the average price per barrel of crude oil at the wells increased to $2.79 in 1954 from the 1953 average of $2.70.

Exploratory drilling in 1954 declined about 14 percent compared with a 13-percent gain in proved-field drilling in 1953. Despite this shift, the panhandle area of the State reported its biggest exploratory year in history. Southern and southwestern counties also reported significant increases in exploratory drilling. Of the 859 exploratory wells drilled in 1954, 156 were oil productive and 25 were gas productive—21-percent productive success compared with 29-percent success during the previous year. According to the American Petroleum Institute, recoverable proved reserves as of December 31, 1954, were estimated at 1,955 million barrels, nearly 12 percent over the 1953 estimated reserves.

The daily average demand for total crude oil was 514,000 barrels in 1954, compared with 560,000 barrels in 1953. Crude-oil stocks, as of December 31, 1954, were 4.7 million barrels at refineries and 19.2 million barrels in pipelines and tank farms.

At the end of 1954, 19 operating refineries were in Oklahoma with a total daily crude-oil capacity of 352,100 barrels and 4 inactive refineries with a daily crude-oil capacity of 28,300 barrels. Cracked-gasoline capacities of these plants were 117,000 barrels daily as operating, 11,200 barrels daily as shut down, and 13,400 barrels daily as under construction. The general trend of the refining industry was toward more capacity for manufacturing higher octane rated motor fuels by means of the catalytic cracking and reforming processes.

During the year a 1,000-barrel-per-day Catformer was placed in operation at Anderson-Prichard Oil Corp. refinery at Cyril and a new

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5,000-barrel-per-day Platformer in operation at the Duncan refinery of Sunray Oil Corp. The Chicago Corp., Fort Worth, Tex., contracted for constructing a 9,000-barrel-per-day fluid catalytic-cracking unit and a 5,000-barrel-per-day Platformer at the Enid, Okla., refinery of its subsidiary, Champlin Refining Co. Construction was underway on a $4.5-million expansion program at the Kerr-McGee Oil Industries, Inc., refinery in Wynne Wood. Mid Continent Petroleum Corp. installed a 60,000-barrel-per-day catalytic reformer at its West Tulsa refinery and planned to enlarge its alkylation unit to 2,200 barrels per day.

TABLE 8.—Production of petroleum (crude), 1945–49 (average) and 1950–54

Year	Thousand 42-gallon barrels	Value		Year	Thousand 42-gallon barrels	Value	
		At wells	Average per barrel			At wells	Average per barrel
1945–49 (average)	144,245	$285,730,000	$1.98	1952	190,435	$487,510,000	$2.56
1950	164,599	423,020,000	2.57	1953	202,570	546,940,000	2.70
1951	186,869	480,250,000	2.57	1954	185,851	518,520,000	2.79

TABLE 9.—Production of petroleum (crude) in 1954, by months

Month	Thousand 42-gallon barrels	Month	Thousand 42-gallon barrels	Month	Thousand 42-gallon barrels
January	16,176	June	14,203	November	14,733
February	15,387	July	14,671	December	15,399
March	17,388	August	15,156		
April	16,936	September	14,526	Total: 1954	185,851
May	16,359	October	14,917	1953	202,570

TABLE 10.—Production of crude petroleum, 1950–54, by fields, in thousand barrels

[Oil and Gas Journal]

Field	1950	1951	1952	1953	1954
Allen	1,359	1,447	1,336	1,456	1,709
Beebe	1,272	1,073	1,244	1,087	926
Burbank	2,124	2,318	3,157	3,476	3,466
Cache Creek	1,511	1,289	1,042	956	787
Camp	(1)	(1)	975	1,606	1,329
Cement	4,091	4,127	3,964	4,070	3,517
Cumberland	3,628	3,475	3,102	2,562	1,690
Cushing	2,759	2,816	2,889	3,385	3,176
Dilworth	(1)	(1)	(1)	(1)	1,279
Doyle	(1)	(1)	2,475	3,934	2,976
Elk City	5,066	7,426	7,248	6,380	5,348
Eola	595	891	1,178	1,651	1,424
Fox-Graham	923	3,196	5,532	5,920	4,559
Glenn	2,551	2,502	2,252	2,145	2,045
Healdton	2,382	2,267	2,183	2,288	2,171
Hewitt	4,320	3,694	3,173	2,703	[2] 3,339
Holdenville—East	(1)	(1)	(1)	(1)	[2] 1,149
Hoover—Northwest	1,034	887	693	601	[4] 1,189
Knox	1,886	1,725	1,627	1,595	1,165
Milroy	(1)	(1)	1,091	2,325	1,755
Oklahoma City	6,785	6,303	5,513	5,187	4,148
Olympic	646	1,485	2,013	4,064	4,083
Payson—East	(1)	(1)	(1)	1,725	1,076
Ringwood	1,927	2,288	1,338	855	727

See footnotes at end of table.

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TABLE 10.—Production of crude petroleum, 1950–54, by fields, in thousand barrels—Continued

Field	1950	1951	1952	1953	1954
Seminole districts:					
Bowlegs	1,201	1,178	1,003	1,121	872
Little River	1,016	945	852	826	756
St. Louis	1,405	1,560	1,440	1,507	1,464
Seminole City	1,164	1,207	1,077	1,211	998
Sholem Alechem	8,545	10,557	12,239	12,736	10,261
South Burbank	860	776	617	894	[5] 1,429
Tatums	3,456	3,378	3,466	3,892	3,321
Velma—West	10,227	16,089	[6] 18,999	[6] 16,064	8,435
West Edmond	3,914	3,482	4,471	1,887	[7] 1,821
Witcher	1,942	1,655	1,120	660	[8] 541
Yale-Quay	825	1,352	1,891	2,171	[9] 1,915
Other fields	84,429	95,478	[6] 90,323	[9] 99,630	[10] 99,005
Total	163,843	186,866	191,523	[9] 202,570	[10] 185,851

[1] Included with "Other fields."
[2] Includes Brock-West and Lone Grove-Southwest.
[3] Includes Grief Creek.
[4] Includes Hoover-North, Brady-Southwest, and Roady-Northeast.
[5] Includes Fairfax, Coon Creek, and Arcadia-Northeast.
[6] Revised figure.
[7] Includes Edmond Northwest and Lockridge-Northeast.
[8] Includes Munger and Munger-South.
[9] Bureau of Mines figure.
[10] Preliminary figure.

TABLE 11.—Indicated demand for petroleum in 1954, by months

Month	Thousand 42-gallon barrels	Month	Thousand 42-gallon barrels	Month	Thousand 42-gallon barrels
January	15,443	June	15,818	November	14,006
February	16,311	July	13,579	December	17,211
March	16,675	August	15,686		
April	16,212	September	15,222	Total: 1954	187,558
May	16,261	October	15,134	1953	204,389

TABLE 12.—Oil- and gas-wells drilled in 1954, by counties [1]

County	Proved field wells			Exploratory wells			Total		
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry
Alfalfa				1		4	1		4
Aotka	1		2			1	1		3
Beaver	3	2	4	2	3	7	5	5	11
Beckham	11		20	2		10	13		30
Bryan						4			4
Caddo	96	6	16			9	96	6	25
Canadian	1						1		
Carter	498	7	86	9		24	507	7	110
Choctaw						3			3
Cimarron		40	2		3	7		43	9
Cleveland	35		15			11	35		26
Coal	6	2	10			4	6	2	14
Comanche	23	3	16	1		15	24	3	31
Cotton	41		34			10	41		44
Creek	548	13	249	4	1	11	552	14	260
Custer						1			1
Delaware						2			2
Ellis						1			1
Garfield	95	7	66	5		19	100	7	85
Garvin	365	13	73	11		28	376	13	101
Grady	144	12	29	10		11	154	12	40
Grant	2	1	6	1	1	17	3	2	23

See footnotes at end of table.

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TABLE 12.—Oil- and gas-wells drilled in 1954, by counties [1]—Continued

County	Proved field wells			Exploratory wells			Total		
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry
Greer	5		9	4		11	9		20
Harmon						1			1
Harper						3			3
Hughes	211	33	74	3		13	214	33	87
Jackson	61		18			8	61		26
Jefferson	31		18			15	31		33
Johnston	1						1		
Kay	207	7	116	10	1	54	217	8	170
Kingfisher	10		1			1	10		2
Kiowa	4	2	11	1		18	5	2	29
Le Flore					1	5		1	5
Lincoln	269	11	142	12	1	68	281	12	210
Logan	56	5	45	6		23	62	5	68
Love	1		2	2		1	3		3
Major	5		1	2			7		1
Marshall	20		7				20		7
Mayes						2			2
McClain	22		8	3		6	25		14
McCurtain	3		6			3	3		9
McIntosh	3	4	3				3	4	3
Murray			3			9			12
Muskogee	1		2				1		2
Noble	76	3	62	7		25	83	3	87
Nowata	49	2	27	3		3	52	2	30
Okfuskee	139	15	102	3	1	16	142	16	118
Oklahoma	39	2	19	6		8	45	2	27
Okmulgee	241	9	140	2		2	243	9	142
Osage	440	6	274	9		27	449	6	301
Ottawa	1			1			2		
Pawnee	98	3	69	1	1	23	99	4	92
Payne	181	7	90	4	1	30	185	8	120
Pittsburg	1		3			4	1		7
Pontotoc	269	31	97	2		16	271	31	113
Pottawatomie	85		42	1		17	86		59
Pushmataha						2			2
Roger Mills						2			2
Rogers	27	5	18	4	1	10	31	6	28
Seminole	281	8	133	2		10	283	8	143
Sequoyah					1	1		1	1
Stephens	448	15	100	9		19	457	15	119
Texas	17	77	9	4	8	1	21	85	10
Tillman	16		4	2		13	18		17
Tulsa	8	2	3			2	8	2	5
Wagoner			1						1
Washington	55	2	17	2		3	57	2	20
Washita	6	2	3	2	1	2	8	3	5
Woods	5	1	1	3		2	8	1	3
Total: 1954	[2] 5,261	358	[3] 2,308	156	25	678	5,417	383	2,986
1953	4,498	348	2,164	253	35	710	4,751	383	2,874

[1] National Oil Scouts and Landmen's Association, Gas and Field Development in United States: Vol. 25, 1954, p. 579.
[2] Includes 71 conditioned wells.
[3] Includes 328 service wells.

TABLE 13.—Sales of petroleum products, 1950–54, in thousand 42-gallon barrels

Product	1950	1951	1952	1953	1954
Gasoline [1]	16,813	17,692	18,891	19,328	19,637
Kerosine	1,939	1,884	1,761	1,588	1,458
Range oil	923	1,012	942	852	763
Distillate fuel oil	1,928	2,223	2,192	2,436	2,368
Residual fuel oil	4,704	3,773	2,939	2,351	1,479

[1] American Petroleum Institute.

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TABLE 14.—Capacity of petroleum refineries and cracking plants as of January 1, 1955

[Barrels per day]

Company	Location	County	Type of plant	Crude oil capacity		Cracked gasoline capacity	
				Operating	Shutdown	Operating	Shutdown
Allied Materials Corp.	Stroud	Lincoln	Skimming and asphalt	3,000			
Anderson Prichard Oil Corp.	Cyril	Caddo	Skimming, cracking, and asphalt.	11,000		4,000	
Bell Oil & Gas Co.	Grandfield	Tillman	Skimming and cracking	8,000		3,600	
Ben Franklin Refining Co.	Ardmore	Carter	do	12,000		7,100	
Champlin Refining Co.	Enid	Garfield	Complete	20,000		[1] 6,500	
Cities Service Oil Co.	Ponca City	Kay	Skimming and cracking	23,000		7,400	
Continental Oil Co.	do	do	Complete	55,000		16,205	1,555
Deep Rock Oil Corp.	Cushing	Payne	do	19,000		3,800	
Harper Oil Co.	Edmond	Oklahoma	Skimming		1,800		
Johnson Oil Refining Co.	Cleveland	Pawnee	Skimming and cracking	6,300		3,000	
Kerr-McGee Oil Industries, Inc.	Wynne Wood	Garvin	Skimming, cracking, and asphalt.	15,000		3,955	
Mercury Oil Refining Co	Oklahoma City	Oklahoma	Skimming and cracking	5,000		700	
Mid Continent Petroleum Corp.	West Tulsa	Tulsa	Complete	59,000	2,500	20,100	2,000
Midland Cooperatives, Inc.	Cushing	Payne	Skimming and cracking	10,500		2,554	
Monarch Refineries, Inc.	Oklahoma City	Oklahoma	Skimming and asphalt	1,000			
Phillips Petroleum Co.	Okmulgee	Okmulgee	Skimming and cracking	16,000		4,700	
Sunray Oil Corp.	Allen	Pontotoc	do		12,000		5,600
Do.	Duncan	Stephens	do	33,000		11,750	
The Texas Co.	West Tulsa	Tulsa	do	35,000		[2] 15,500	
Tide Water Associated Oil Co.	Drumright	Creek	do	15,000	12,000	2,300	2,000
Wilcox Oil Co.	Bristow	do	do	5,300		3,800	
Total				352,100	28,300	116,964	11,155

[1] In addition 5,900 barrels per day, building.
[2] In addition, 7,500 barrels per day, building.

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METALS

Output of metallic minerals in 1954 recovered considerably from the marked decline in production experienced during the latter half of 1953. Advancing metal prices stabilized the production of lead and zinc throughout 1954. The stabilization was due in part to the Government stockpiling program, which helped to reduce National combined lead and zinc stocks from nearly 245 thousand tons in January to about 200 thousand tons in December 1954.

Cadmium, Germanium, Indium, and Gallium.—These minor metals, found as trace elements in the lead-zinc concentrates of Oklahoma, were recovered from the flue and zinc dusts of zinc-retort smelters and from the precipitates of electrolytic zinc smelters. Production of these metals cannot be assigned to State of origin, because they are recovered at the smelters from the accumulated flue dusts and residues of ores from various domestic and foreign sources.

Lead.—Mine production of lead in 1954, all from Ottawa County, was 56 percent more than in 1953, in terms of concentrate (galena) and 53 percent more in terms of recoverable metal. The value of the 14,200 short tons of recoverable lead was $3.9 million, a gain of nearly 60 percent over the 1953 value. The largest producer of lead in the State was Eagle-Picher Co., followed by American Zinc, Lead & Smelting Co., Dewey Sims (Ritz), John Henderson (Acme), and Tom Kiser (Wesah Greenback). No labor strikes were reported within the State.

TABLE 15.—Mine production of lead and zinc, 1945–49 (average), 1950–54, and total 1891–1954, in terms of concentrates and recoverable metals [1]

Year	Lead concentrate (galena)		Zinc concentrate (sphalerite)		Recoverable metal content [2]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	20,690	$3,767,173	103,758	$10,695,647	15,485	$4,322,232	55,554	$13,568,652
1950	27,261	4,218,880	87,116	8,247,342	20,724	5,595,480	46,739	13,273,876
1951	22,613	4,714,358	99,612	12,297,096	16,575	5,734,950	53,450	19,455,800
1952	20,473	4,104,934	101,726	11,714,605	15,137	4,874,114	54,916	18,232,112
1953	12,213	1,915,195	61,896	4,541,616	9,304	2,437,648	33,413	7,684,990
1954	19,004	3,194,245	84,444	5,466,727	14,204	3,891,896	43,171	9,324,936
1891–1954	1,619,869	153,381,717	9,562,348	468,767,083	1,245,800	183,041,999	5,041,839	749,436,986

[1] Based on Oklahoma ore ("dirt") and old tailings treated at mills during calendar year indicated.
[2] In calculating metal content of the ores from assays, allowance has been made for smelting losses of both lead and zinc. In comparing the values of concentrate ("ore") and metal it should be borne in mind that the value given for the concentrate is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

The price of lead opened at 13.50 cents per pound, New York, in 1954, declined to a low of 12.50 cents in March, and then rose gradually to 15.00 cents in October as the Government purchase program for lead and zinc took effect.

Zinc.—Mine production of recoverable zinc, all from Ottawa County, increased 29 percent from the previous year to 43,200 tons as metal stocks declined and metal prices rose during 1954. Zinc output was valued at $9.3 million, a gain of 21 percent over the 1953 value.

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TABLE 16.—Tenor of lead-zinc ore milled and concentrates produced, 1953–54

	Crude ore	
	1953	1954
Total material milled ..... short tons	2,090,760	2,754,373
Total concentrate produced:		
Galena ..... do	12,213	19,004
Sphalerite ..... do	61,896	84,444
Ratio of concentrate to material milled:		
Lead ..... percent	0.58	0.69
Zinc ..... do	2.96	3.07
Metal content of material milled:[1]		
Lead ..... do	0.45	0.52
Zinc ..... do	1.60	1.57
Average lead content of galena concentrate ..... do	77.74	76.27
Average zinc content of sphalerite concentrate ..... do	59.98	56.79
Average value per ton:		
Galena concentrate	$156.82	$168.08
Sphalerite concentrate	$73.37	$64.74

[1] Figures represent metal content of the crude ore (dirt) only insofar as it is recovered in the concentrate. Data on tailing losses not available.

TABLE 17.—Mine production of lead and zinc in 1954, by months, in terms of recoverable metals

Month	Lead (short tons)	Zinc (short tons)	Month	Lead (short tons)	Zinc (short tons)
January	923	3,314	August	1,260	3,781
February	938	3,293	September	1,288	3,491
March	1,062	3,873	October	1,630	3,654
April	993	3,464	November	1,434	3,880
May	1,100	3,728	December	1,362	3,630
June	1,109	3,596			
July	1,105	3,467	Total	14,204	43,171

Eagle-Picher Co. was the principal producer followed by American Zinc, Lead & Smelting Co., Buffalo Mining Co., John Henderson (Acme), and Tongaha Mining Co.

Zinc-metal price at the beginning of 1954 was quoted at 10.00 cents per pound, East St. Louis. The price declined to a low of 9.25 cents in February, increased slightly with the rise in the London market and in anticipation of expanded Government stockpiling, reached a peak price of 11.50 cents in September, and remained there for the rest of the year.

TRI-STATE DISTRICT

The Tri-State district of Oklahoma, Kansas, and Southwest Missouri produced 4.1 million tons of crude ore in 1954, compared with 3.5 million tons in 1953. This increased production yielded 24,500 tons of lead concentrate containing 18,300 tons of recoverable lead and 127,100 tons of zinc concentrate (including 360 tons from old tailings milled) containing 64,300 tons of recoverable zinc. Compared with 1953, crude ore mined in 1954 was up 18 percent, lead-concentrate recovery was up 41 percent, and zinc-concentrate recovery was up 24 percent. Oklahoma furnished 78 percent of the district's lead concentrate and 66 percent of the zinc concentrate; Kansas provided 22 percent of the district's lead concentrate and 31 percent of its zinc concentrate; Southwest Missouri supplied less than 1 percent of the district's lead concentrate and 3 percent of its zinc concentrate. The

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district's average concentrate recoveries in 1954 were 3.09 percent for zinc and 0.60 percent for lead, or 3.70 percent for combined lead-zinc concentrate as compared with 3.48 percent lead-zinc-concentrate recovery in 1953.

The 127 mines operating in the Tri-State district in 1954 included: 96 in Oklahoma, 26 in Kansas, and 5 in Southwest Missouri. The district's largest lead-zinc producer was Eagle-Picher Co. (Oklahoma-Kansas) followed by American Zinc, Lead & Smelting Co. (Oklahoma-Missouri), National Lead Co. (Kansas), Buffalo Mining Co. (Oklahoma), and John Henderson (Oklahoma-Kansas). The Quick Seven operation of American Zinc, Lead & Smelting Co. in Southwest Missouri closed permanently because of depleted ore reserves. There were 9 mills operating in January and 7 operating in December. A tailing mill reported some mill cleanup early in the year. One mine mill started late in the year, and three shut down. Six of the mine mills were in Oklahoma.

TABLE 18.—Quoted prices of 60-percent zinc concentrate and 80-percent lead concentrate at Joplin, Mo., in 1954 [1]

Zinc concentrate		Lead concentrate	
Week ended—	Price per short ton	Week ended—	Price per short ton
Jan. 1–Jan. 11	$56	Jan. 1–Jan. 11	$166.25
Jan. 25–Jan. 31	52	Jan. 19–Jan. 24	159.05
Feb. 23–Mar. 1	50	Feb. 23–Mar. 1	151.85
Mar. 12–Mar. 22	54	Mar. 12–Mar. 22	159.05
Apr. 2–Apr. 12	58	Mar. 30–Apr. 1	166.25
May 28–June 7	60	Apr. 2–Apr. 12	169.85
June 8–June 14	64	Apr. 13–Apr. 19	173.45
Sept. 7–Dec. 31	68	Aug. 31–Sept. 6	177.05
		Sept. 14–Sept. 20	180.65
		Sept. 21–Sept. 27	184.25
		Oct. 5–Dec. 31	187.85

[1] E&MJ Metal and Mineral Markets.

TABLE 19.—Mine production of lead and zinc concentrates in the Tri-State district, 1945–49 (average) and 1950–54 in terms of concentrates and recoverable metals

Year	Lead concentrates (galena)		Zinc concentrates (sphalerite)		Recoverable metal content			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	34,367	$6,245,059	205,712	$21,126,704	25,788	$7,103,037	110,223	$26,897,001
1950	40,714	6,245,660	150,019	13,934,927	31,157	8,412,390	80,558	22,878,472
1951	36,300	7,720,550	170,263	21,023,818	26,906	9,309,476	91,553	33,325,292
1952	36,333	7,388,754	167,474	19,537,949	27,356	8,808,632	90,512	30,049,984
1953	17,403	2,715,987	102,821	7,455,540	13,273	3,477,526	55,729	12,817,670
1954:								
Kansas	5,390	916,161	[1] 38,896	2,638,102	4,033	1,105,042	[2] 19,110	4,127,760
Southwest Missouri	103	16,826	3,713	378,782	77	21,098	2,041	440,856
Oklahoma	19,004	3,194,245	84,444	5,466,727	14,204	3,891,896	43,171	9,324,936
Total 1954	24,497	4,127,232	[1] 127,053	8,483,611	18,314	5,018,036	[2] 64,322	13,893,552

[1] Includes 360 tons from old tailings remilled.
[2] Includes 194 tons from old tailings remilled.

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Three zinc-retort smelters in Oklahoma operating in 1954 were: American Metals Co., Ltd., Blackwell, Kay County; Eagle-Picher Co., Henryetta, Okmulgee County; and National Zinc Co., Bartlesville, Washington County. Most of the smelting companies curtailed production, as metal stocks increased substantially during the first half of the year.

TABLE 20.—Tenor of ore and concentrates in Tri-State district, 1950–54

	1950	1951	1952	1953	1954
Total material milled:					
Crude ore, short tons	4,700,698	5,990,100	6,140,155	3,454,980	4,092,278
Tailings and slimes, do	967,926	746,673	604,350	----------	18,000
Ratio of concentrates to material milled:					
Lead, percent	0.72	0.54	0.54	0.50	0.60
Zinc, do	2.65	2.53	2.48	2.98	3.09
Metal content of material milled:					
Lead, do	.55	.40	.41	.38	.45
Zinc, do	1.42	1.36	1.34	1.61	1.56
Average lead content of galena concentrate, percent	78.08	75.62	76.79	77.81	76.28
Average zinc content of sphalerite concentrate, percent	59.66	59.74	60.04	60.22	56.24
Average value per ton:					
Galena concentrate	$153.40	$212.69	$203.36	$156.06	$168.48
Sphalerite concentrate	$92.89	$123.48	$116.66	$72.51	$66.77

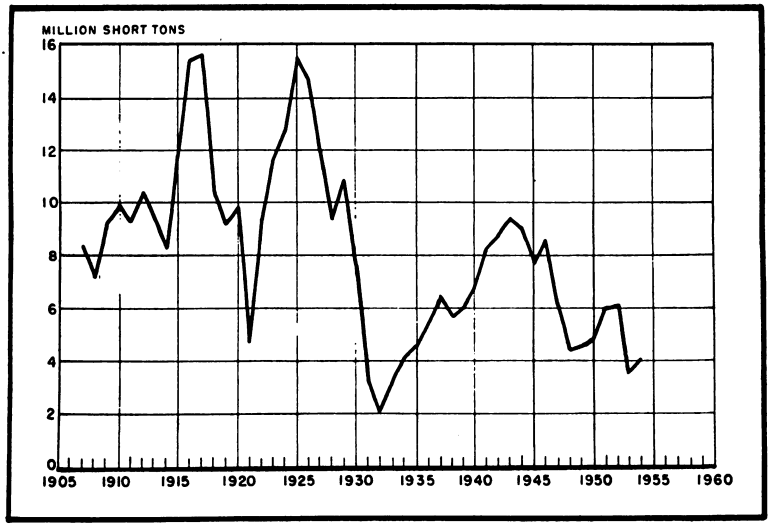

FIGURE 1.—Quantity of crude ore (rock) milled in the Tri-State district, 1907–54.

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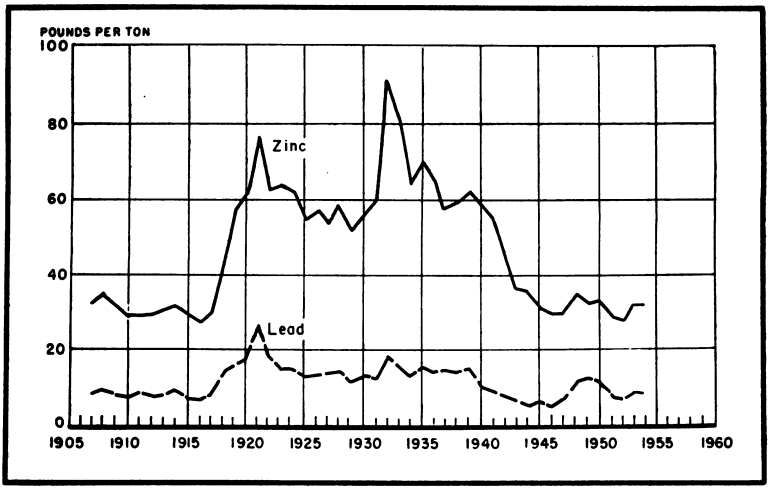

FIGURE 2.—Metal recovered per ton of crude ore (rock) milled in the Tri-State district, 1907–54.

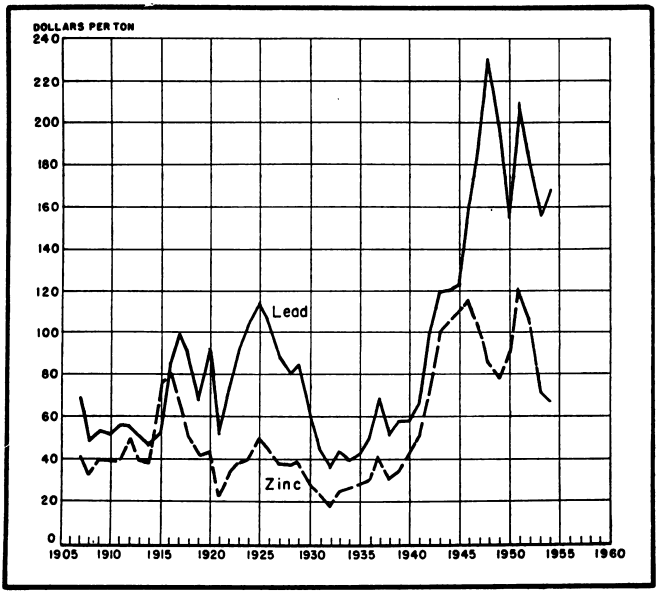

FIGURE 3.—Average prices received by sellers per ton of concentrate in the Tri-State district, 1907–54.

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NONMETALS

Total value of the nonmetallic minerals produced in Oklahoma in 1954 surpassed the record high of $24.2 million by approximately 7 percent in 1952. Increased construction activity and manufacture of diverse nonmetallic products by new plants resulted in the new production record. The net gain in nonmetals helped offset the 1954 decline in total Oklahoma value which resulted chiefly from lower production allowables of crude petroleum.

Cement.—Cement was the leading nonmetallic mineral product in value produced in Oklahoma in 1954. The two plants at Dewey, Washington County, and at Ada, Pontotoc County, reported slight increases in output in 1954, establishing a new production record. The Dewey Portland Cement Co., Washington County, made several additions to its plant during the year.

Clays.—Oklahoma has extensive clay resources. Production in 1954 was used primarily for manufacturing brick and tile, and also portland cement, and lightweight expanded clay products. Brick and tile were produced by 12 plants in Creek, Custer, Garfield, Greer, Oklahoma, Pittsburg, Pontotoc, Seminole, and Tulsa Counties. Bentonite was produced in Dewey County. Expanded lightweight aggregate was made from clay in Oklahoma County. The value of clays produced in 1954 is not comparable with previous years because certain large producers increased the book value of clay used in the manufacture of brick and heavy clay products.

A significant report [6] on preparation of lightweight aggregate from Oklahoma shale, was published in 1954.

TABLE 21.—Clays sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	449,104	$329,931	1952	520,050	[1]$577,420
1950	555,910	493,659	1953	577,557	637,082
1951	551,144	561,644	1954	452,050	1,282,848

[1] Revised figure.

Gypsum.—Alltime highs in tonnage and value of gypsum were recorded in Oklahoma in 1954, in response to higher demands for wallboard, plasters, and portland cement. All production was from Blaine County; the United States Gypsum Co. operated a plant and quarries at Southard; Universal Atlas Cement Co. operated a quarry near Watonga; and S. A. Walton a quarry near Southard, about 11 miles west of Okeene.

Lime.—Lime production from high-purity limestone in Oklahoma decreased in 1954 during conversion from open-face quarrying to underground mining by the St. Clair Lime Co. Limestone, quarried by this company from the St. Clair formation at Marble City, was burned in shaft kilns at Sallisaw, Sequoyah County. The product was sold chiefly for chemical uses in manufacturing calcium carbide, purifying water, and in steel metallurgy.

[6] Burwell, A. L., Lightweight Aggregate From Certain Pennsylvania Shales: Oklahoma Geol. Survey Mineral Rept., Sept. 30, 1954, 20 pp.

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Perlite.—Perlite was expanded at a Tulsa plant, chiefly for use in concrete and plaster. All crude perlite was shipped from other States, as no deposits are known in Oklahoma.

Pumicite.—Pumicite (volcanic ash) was produced by Dyer & Kite from deposits near Gate in eastern Beaver County, and by E. L. Henderson near Custer City in Custer County. Production, which decreased slightly in 1954, was used mostly in manufacturing hand soaps, filters, and as an admixture in paints and concrete.

Salt.—Output of salt, reported by three producers in three counties, increased in 1954. At Sayre, Beckham County, salt continued to be produced by injecting fresh water through wells into a salt bed and recovering the brine by surface evaporation. In Woods County, salt was produced from surface encrustations on the Big Salt Plain of the Cimarron River; and in Harmon County, by solar evaporation of brine from springs. Principal uses were for stock food and for recharging water softeners.

Sand (Ground).—For the fifth consecutive year ground silica produced from high-purity glass sand increased in tonnage and value. This material, produced by Pennsylvania Glass Sand Corp., Mill Creek, Johnston County, was used mostly in cleansing and scouring compounds, as a filler, and for pottery, porcelain, and tile.

Sand and Gravel.—Sand and gravel suitable for concrete aggregate and road surfacing may be found along most of the larger streams in Oklahoma. Production was reported from 46 counties in the State in 1954; Johnston, Tulsa, Oklahoma, Muskogee, Murray, Pontotoc, and Kingfisher, the leading counties, supplied 57 percent of the total value.

Most of the sand and gravel produced in Oklahoma was used for paving concrete and mortar. High-purity glass sand, second in tonnage and value, was produced at three plants in the Arbuckle Mountain district; a small part was used as foundry sand and for making sodium silicate.

TABLE 22.—Sand and gravel sold or used by producers, 1945–49 (average) and 1950–54

Year	Commercial		Noncommercial		Total		
	Short tons	Value	Short tons	Value	Short tons	Value	
						Total	Average per ton
1945–49 (average)	1,306,017	$979,065	583,423	$110,429	1,889,440	$1,089,494	$0.58
1950	1,730,067	1,500,667	1,556,767	856,186	3,286,834	2,356,853	.72
1951	2,164,382	2,103,710	1,018,869	217,943	3,183,251	2,321,653	.73
1952	2,353,559	2,209,098	1,416,104	702,747	3,769,663	2,911,845	.77
1953	[1] 2,997,504	2,927,681	2,013,862	1,330,904	[1] 5,011,366	4,258,585	.85
1954	3,210,890	3,379,576	2,213,241	885,455	5,424,131	4,265,031	.80

[1] Revised figure.

Sand and gravel (including glass sand) produced in Oklahoma during 1954 amounted to 5 million tons valued at $4.3 million—an 8-percent increase in tonnage but slight change in value compared with 1953.

Stone.—Oklahoma stone producers reported in 1954 a total of over 9 million tons of crushed limestone, dimension granite, dimension

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limestone, dimension sandstone, and miscellaneous stone. The reported production, valued at $9.2 million, was a 15-percent increase in value and a 9-percent increase in tonnage compared with 1953. Production of stone was reported from 28 counties; Tulsa, Comanche, Murray, Kiowa, Ottawa, and Atoka supplied most of the tonnage. The leading commodity, crushed limestone and dolomite, used primarily for concrete and road construction, was produced by 27 of the 48 stone producers.

TABLE 23.—Stone sold or used by producers, 1950–54, by kinds

Year	Granite		Limestone		Sandstone	
	Short tons	Value	Short tons	Value	Short tons	Value
1950	216,930	$646,872	2,992,920	$3,334,374	19,480	$18,700
1951	4,267	527,500	4,765,419	5,279,311	146,317	213,625
1952	5,337	511,073	[1] 6,355,780	[1] 6,940,219	1,350	11,300
1953	[2] 6,862	[2] 702,250	[2] 5,654,022	[3] 6,029,258	228,897	137,407
1954	11,022	665,753	[1 3] 6,974,697	[1 3] 7,527,413	160,883	233,469

Year	Other Stone		Total	
	Short tons	Value	Short tons	Value
1950	1,792,330	$848,277	5,021,660	$4,848,223
1951	2,050,673	897,112	6,966,676	6,917,548
1952	3,274,008	1,511,742	[1] 9,636,475	[1] 8,974,334
1953	2,600,213	1,061,822	[2] 8,489,994	[2] 7,930,737
1954	2,092,209	720,360	[1 3] 9,238,811	[1 3] 9,146,995

[1] Excludes dimension limestone.
[2] Revised figure.
[3] Includes limestone used in cement and lime.

Chat.—Chat is the term used in the Tri-State mining area to denote the coarse tailings obtained in milling zinc and lead ores. The material is composed mostly of chert or microcrystalline silica, with small quantities of limestone, sphalerite, galena, marcasite, and pyrite.

Most of the chat sold was used for railroad ballast, concrete aggregate, and road surfacing. In 1954, operators reported sales of 2,092,000 tons valued at $720,000 compared with 2,600,000 tons valued at $1,062,000 in 1953. All of the chat sold was produced in Ottawa County.

Granite.—The dimension-granite industry of Oklahoma is centered in the Wichita Mountain district, in the southwestern part of the State, where seven producers operated quarries in Comanche, Greer, and Kiowa Counties in 1954. Crushed granite also was produced in Jackson County for airbase construction at Altus.

Production from Precambrian granites that are predominantly pink and red was used mostly for monumental stone and partly for exterior trim. Much of the stone was finished in plants of the Wichita Mountains, but some was shipped as rough rock to other States. In 1954 granite production was reported to be 11,000 tons, with a value of $666,000.

Limestone and Dolomite.—Oklahoma has abundant resources of limestone and dolomite. In 1954 limestone or dolomite was pro-

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duced from 28 quarries in 21 counties; the greatest production was from Tulsa, Comanche, and Murray Counties.

Chemical-grade limestone was quarried at Marble City in Sequoyah County for limemaking and as a flux in glass manufacturing. Chemical-grade dolomite was produced at Troy, Johnston County, for glass manufacturing, fertilizers, and mineral feeds.

Dimension limestone was quarried for building stone in the Arbuckle Mountains near Eldorado, Jackson County; limestone for portland cement was quarried in Washington and Pontotoc Counties.

For the first time limestone used to manufacture lime and cement is included; hence the 1954 and 1953 totals are not comparable.

Sandstone.—Dimension sandstone produced in Oklahoma was used for building and veneer stone in building construction. The stone was cut in slabs 1½ to 6 inches thick from shallow, open-face quarries in Pushmataha, Okmulgee, Sequoyah, and Choctaw Counties. Approximately 6,000 tons valued at $89,000 was produced in 1954.

Stone, Crushed (Government and Contractor).—Stone crushed by municipal, county, and State agencies included limestone and sandstone obtained from local quarries throughout the State.

Sulfur.—A decrease in tonnage and value of sulfur, produced from waste natural gases by Joe L. Parker at Madill, Marshall County, was reported in 1954.

Tripoli.—Tripoli mined in eastern Ottawa County in 1954 showed a slight decrease over that produced in 1953. All of it was shipped to Seneca, Mo., where it was processed by the American Tripoli Co. and sold chiefly for buffing compounds and foundry use.

REVIEW BY COUNTIES

Production of metals, nonmetals, and mineral fuels in 1954 was reported from 74 of the 77 counties in Oklahoma. The nonproducing counties were Adair, Ellis, and Roger Mills.

Alfalfa.—A small quantity of petroleum was produced from the McWillie–North field, and one oil-discovery well was completed in 1954. Construction sand and gravel was produced by Earl Kirkpatrick; other sand and gravel was produced by the county and State highway departments.

Atoka.—Limestone was crushed at the Southwest Stone Co. quarry near Stringtown for use as railroad ballast, road base, and aggregate in concrete. A small quantity of oil was produced west of Wesley.

Beaver.—Construction sand was quarried from a pit east of Beaver City by Everett Bush. Pumicite (volcanic ash) was produced north of Gate by Dyer & Kite for scouring compounds, paints, and filler mediums. Petroleum and natural gas were produced mainly from the Greenough, Floris, Camp Creek, and Light fields. Two oil wells and three gas wells were completed.

Beckham.—Salt was produced from wells southwest of Sayre by Oklahoma Salt Industries. Petroleum and natural gas were produced from four fields but mostly from the Elk City field. Natural-gas liquids were produced by Shell Oil Co. Two oil-discovery wells were completed.

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TABLE 24.—Value of mineral production in Oklahoma, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954, in order of value
Alfalfa	(2)	$68,016	Sand and gravel, petroleum.
Atoka	(2)	416,480	Stone, petroleum.
Beaver	$1,367,294	1,164,768	Natural gas, petroleum, sand and gravel, pumice.
Beckham	25,635,864	16,580,523	Petroleum, natural-gas liquids, natural gas, salt.
Blaine	(2)	(2)	Gypsum.
Bryan	2,513,135	1,769,739	Petroleum, sand and gravel, natural gas.
Caddo	14,531,362	13,316,836	Petroleum, natural gas, sand and gravel, natural-gas liquids.
Canadian	368,335	489,252	Natural gas, petroleum, sand and gravel.
Carter	64,854,229	63,503,928	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel.
Cherokee	(2)	(2)	Sand and gravel.
Choctaw	(2)	(2)	Stone.
Cimarron	317,994	679,591	Natural gas, petroleum, sand and gravel.
Cleveland	6,532,446	6,578,325	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Coal	2,541,155	2,373,412	Petroleum, natural gas, stone, coal.
Comanche	1,816,800	1,843,856	Stone, petroleum, sand and gravel, natural gas.
Cotton	5,419,571	5,508,154	Petroleum, natural gas, sand and gravel.
Craig	75,973	104,705	Coal, petroleum, natural gas.
Creek	26,487,014	27,139,039	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Custer	(2)	(2)	Clays.
Delaware	(2)	(2)	Sand and gravel.
Dewey	(2)	64,023	Clays, sand and gravel.
Garfield	5,248,820	6,440,599	Petroleum, natural-gas liquids, natural gas, clay.
Garvin	58,929,618	59,775,003	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Grady	8,802,398	8,715,251	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Grant	2,554,722	1,821,866	Petroleum, natural gas.
Greer	112,376	108,583	Stone, clays, petroleum, sand and gravel.
Harmon	(2)	153,865	Natural gas liquids, salt.
Harper	(2)	20,920	Natural gas, petroleum.
Haskell	3,288,924	2,795,944	Coal, natural gas.
Hughes	13,277,561	14,676,018	Petroleum, natural gas, natural-gas liquids.
Jackson	885,833	1,570,295	Petroleum, stone, natural gas.
Jefferson	2,735,795	2,552,028	Petroleum, natural gas.
Johnston	755,100	949,369	Sand and gravel, stone, ground sandstone.
Kay	9,802,965	11,288,540	Petroleum, natural-gas liquids, natural gas, stone.
Kingfisher	1,061,867	1,422,910	Petroleum, natural gas, sand and gravel.
Kiowa	1,021,104	1,153,620	Stone, petroleum, sand and gravel, natural gas.
Latimer	255,399	(2)	Coal, natural gas.
Le Flore	2,449,546	2,435,493	Coal, natural gas, stone, sand and gravel.
Lincoln	26,052,475	25,622,697	Petroleum, natural gas, natural-gas liquids, stone.
Logan	12,425,894	10,706,827	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Love	465,041	479,597	Petroleum.
Major	3,681,553	3,075,292	Petroleum, natural-gas liquids, sand and gravel, natural gas.
Marshall	6,892,370	5,203,540	Petroleum, natural-gas liquids, sulfur, sand and gravel.
Mayes	(2)	8,507	Stone, sand and gravel, petroleum.
McClain	7,505,241	6,501,884	Petroleum, natural gas, sand and gravel.
McCurtain	(2)	(2)	Sand and gravel.
McIntosh	632,622	527,590	Coal, natural gas, petroleum, sand and gravel.
Murray	1,711,842	1,756,737	Stone, asphalt (native), sand and gravel, petroleum.
Muskogee	904,244	1,209,415	Petroleum, sand and gravel, stone, coal, natural gas.
Noble	8,525,356	7,974,173	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Nowata	11,068,791	11,882,474	Petroleum, stone, natural gas.
Okfuskee	8,931,807	12,140,945	Petroleum, natural gas, natural-gas liquids.
Oklahoma	43,552,945	35,375,750	Petroleum, natural-gas liquids, natural gas, clays, sand and gravel.
Okmulgee	6,146,255	6,217,827	Petroleum, coal, natural-gas liquids, natural gas, stone.
Osage	32,977,079	36,825,130	Petroleum, natural-gas liquids, natural gas, stone.
Ottawa	11,274,775	13,989,467	Zinc, lead, stone, tripoli.
Pawnee	5,797,439	6,252,247	Petroleum, sand and gravel, natural-gas liquids, natural gas.
Payne	13,754,676	13,841,312	Petroleum, natural gas, natural-gas liquids, stone, sand and gravel.
Pittsburg	1,709,513	2,299,336	Coal, natural gas, sand and gravel, stone.
Pontotoc	17,624,276	20,005,511	Petroleum, cement, natural-gas liquids, stone, natural gas, sand and gravel, clays.
Pottawatomie	13,910,446	12,632,486	Petroleum, natural-gas liquids, natural gas.
Pushmataha	(2)	(2)	Sand and gravel, stone.
Rogers	3,690,317	4,327,285	Petroleum, coal, natural gas.

See footnotes at end of table.

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TABLE 24.—Value of mineral production in Oklahoma, 1953–54, by counties [1]—Continued

County	1953	1954	Minerals produced in 1954, in order of value
Seminole	$32,802,074	$31,204,639	Petroleum, natural-gas liquids, natural gas, clays.
Sequoyah	1,744,799	1,387,489	Lime, coal, stone, natural gas.
Stephens	95,226,639	70,163,129	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Texas	18,406,324	24,648,657	Natural gas, natural-gas liquids, petroleum, sand and gravel, stone.
Tillman	583,937	643,071	Petroleum, sand and gravel.
Tulsa	5,792,308	6,381,912	Petroleum, stone, sand and gravel, clays, natural gas, coal, natural-gas liquids.
Wagoner	520,264	754,686	Petroleum, sand and gravel, natural gas, coal.
Washington	15,477,262	16,288,538	Petroleum, cement, stone, natural gas, clays.
Washita	1,234,123	1,070,917	Petroleum, natural gas.
Woods	23,769	31,989	Sand and gravel, petroleum, salt, natural gas.
Woodward	[2]	[2]	Sand and gravel.
Various	----------	284,141	Stone.
Undistributed	4,313,344	2,067,513	
Total	679,003,000	[3] 650,205,000	

[1] The following counties are not listed because no production was reported: Adair, Ellis, and Roger Mills.
[2] Value included with "Undistributed" to avoid disclosing individual data.
[3] The total has been adjusted to eliminate duplication in the value of clays and stone.

Blaine.—Gypsum was quarried and crushed at the following plants: United States Gypsum Co., Southard; Universal Atlas Cement Co., northeast of Watonga; S. A. Walton, west of Okeene. The United States Gypsum Co. also operated a large calcining, sheet-rock, and plaster plant at Southard.

Bryan.—Construction sand and gravel was produced from the pits of M & K Sand & Gravel Co. near Colbert and by C. R. Scoval north of Durant. Petroleum and natural gas were produced from the Aylesworth-SE. field.

Caddo.—Petroleum and natural gas were produced from three fields. Cement, the largest of these fields, produced over 3.5 million barrels of oil in 1954. Natural-gas liquids were produced by Apache Gasoline Co. Construction sand and gravel was produced for construction purposes by three operators, and for highways by the State highway department. A 1,000 barrel-per-day Catformer was completed and began operating at the refinery of Anderson-Prichard Oil Corp., Cyril.

Canadian.—Petroleum and natural gas were produced only from the Edmond–West field. Construction sand and gravel was produced by Tindel Material Co.

Carter.—Carter County ranked second in the value of mineral and mineral fuels produced in the State. Petroleum and natural gas were produced from 20 fields, of which Fox-Graham, Healdton, Hewitt, Sholem Alechem, and Tatums produced a total of more than 23 million barrels. Crushed limestone and sand and gravel were produced by H. D. Youngman Co. and by the State highway department, respectively. Natural-gas liquids were produced by Magnolia Petroleum Co., Shell Oil Co., and Harry Ells, Inc. Nine oil-discovery wells were completed in 1954.

Cimarron.—Petroleum and natural gas were produced from 2 fields in the Keyes area, and 3 gas-discovery wells were drilled. Construction sand and gravel was produced northwest of Boise City by Jack Parker, and other sand and gravel was produced for highway purposes.

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Cleveland.—Petroleum and natural gas were produced from 19 fields. Natural-gas liquids were produced by Mid Continent Petroleum Corp. and the Texas Co. Sand and gravel was produced by the State highway department.

Coal.—Petroleum and natural gas were produced from five fields. The Dolese Bros. Co. operated a crusher and limestone quarry near Bromide. Coal was mined by Dunn Fuel & Lumber Co., Phillips Coal Co., B. & S. Coal Co., and 21 Coal Co.

Comanche.—Unfinished dimension granite was prepared in the western part of the county by Ira Smith & Sons, and crushed limestone was produced by Dolese Bros. Co. from its Richards Spur quarry north of Lawton. Sand and gravel was produced by Raymond Eders and by the State highway department. Petroleum and natural gas were produced from a group of small fields comprising three districts and the Fort Sill Reservation field. One oil-discovery well was drilled.

Cotton.—Petroleum and natural gas were produced from a group of fields in Walters and Cache Creek districts and from the Essaquanahdale–West, Rabbit Creek–West, Randlett–South, Randlett–Southwest, and Soldier Creek. Of these fields, Soldier Creek ranked first in 1954, with a production of about 491,000 barrels of oil. A small quantity of construction sand and gravel was produced by Morris sand pit.

Craig.—Coal was strip-mined by Parker mine and Patch Coal Co. Minor quantities of petroleum and natural gas were produced.

Creek.—Petroleum and natural gas were produced from 51 fields. The prolific Cushing and Glenn fields supplied about 5 million barrels of oil during the year. Natural-gas liquids were recovered by plants of Sinclair Oil & Gas Co., Kerr-McGee Oil Industries, Inc., Pure Oil Co., Gulf Oil Corp., and The Texas Co. Clay for manufacturing brick and tile was produced at the Sapulpa plant of Sapulpa Brick & Tile Co. A small quantity of sand and gravel was produced for highway purposes. Four oil-discovery wells and one gas-discovery well were drilled.

Garfield.—Petroleum and natural gas were produced from 26 fields. Natural-gas liquids were produced by Sterling Oil Co. of Oklahoma. This company also constructed a new $500,000 gasoline plant, with a capacity of 14,000 million cubic feet of gas daily to process gas from the East Spring Valley field. The Chicago Corp., Fort Worth, Tex., let contracts for constructing a 9,000-barrel-per-day fluid catalytic-cracking unit and a 5,000-barrel Platformer at the Enid refinery of its subsidiary, Champlin Refining Co. Davies Brick & Tile Co., south of Enid, continued to quarry clay for manufacturing brick. Five oil-discovery wells were drilled.

Garvin.—Garvin County ranked third in the value of minerals and mineral fuels produced in the State. Petroleum and natural gas were produced from 44 fields. The prolific Golden Trend fields supplied about 15 million barrels of oil in 1954. Natural-gas liquids were recovered by Sohio Petroleum Co., Lone Star Gas Co., Otha H. Grimes, and Warren Petroleum Co. Construction was begun on a $4.5 million expansion of Kerr-McGee Oil Industries, Inc., refinery at Wynne Wood. The program will include a new crude-oil unit to increase the plant capacity from 9,000 to 15,000 barrels of crude oil per day, a 6,000-barrel-per-day fluid catalytic-cracking unit, a

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catalytic-polymerization unit, and a gas-condensate unit. Construction sand and gravel was obtained from deposits east of Pauls Valley by Elmer Long and by Lamar Lawson. Government-and-contractor sand and gravel was produced for highways. Exploratory drilling resulted in the discovery of 11 oil pools.

Grady.—Petroleum and natural gas were produced from 11 fields. Natural-gas liquids were recovered by Magnolia Petroleum Co. Ten exploratory wells proved oil productive. Contractor and construction sand and gravel was produced. Construction sand and gravel was obtained from pits near Tuttle by Dolese Bros. Co.

Grant.—Petroleum and natural gas were produced from the following 10 fields: Deer Creek, Eureka-Southeast, Jarvis-North, Pond Creek-East, Prairie Home-South, Renfrow-East, Rich Valley, Rich Valley-Southeast, Webb, and Ann Webb-North. Exploratory drilling resulted in the discovery of 1 oil well and 1 gas well.

Greer.—Granite was quarried by the Granite Monument Works near the town of Granite. Clay was produced from the pit of Mangum Brick & Tile Co., south of Mangum. Construction sand and gravel was produced by D. J. Cox, J. G. Dillahunty, Granite Gravel Co., and S. D. Vaughn. Petroleum was produced from the Lake Creek oil field, and four oil-discovery wells were drilled.

Harmon.—Natural-gas liquids were recovered by the Lone Star Gas Co. Salt was produced by W. W. Flowers & Sons by solar evaporation of brine from salt springs.

Haskell.—Haskell County ranked first in value of coal produced. Coal was mined by Lone Star Steel Co., Garland Coal Mining Co., Cedar Creek Coal Co., Fred Dock, Reliance Coal & Coke Co., Bisby Coal Co., McAlpine Coal Co., Cary Contracting Co., and Choctaw Coal Co., Inc. Five were operating underground. Natural gas was produced from the Quinton and Kinta districts.

Hughes.—Petroleum and natural gas were produced from 39 fields. The Holdenville-East field, discovered in 1946, furnished 2.7 million barrels of oil. Natural-gas liquids were recovered by Grimes Gasoline Co. Three oil-discovery wells were drilled.

Jackson.—Petroleum and natural gas were produced from five fields southeast of Altus. Dimension limestone was quarried by Eldorado Stone Co.

Jefferson.—Petroleum and natural gas were produced from eight fields: Asphaltum, Healdton, Oscar, Oscar-North, Ringling-North, Seay, Spring, and Woodrow.

Johnston.—The Pennsylvania Glass Sand Corp. of Oklahoma continued to produce glass sand and ground silica from pits north of Mill Creek. Claud Lamb produced construction sand from a pit east of Tishomingo. Government-and-contractor sand and gravel was produced for highways. The Rock Products Manufacturing Corp. produced crushed dolomite from its quarry near Troy.

Kay.—Petroleum and natural gas were produced from 29 fields, and natural-gas liquids were recovered by Cities Service Oil Co. At Ponca City, Continental Blacks, Inc., began operating its new $2,750,000 carbon-black plant. Cookson Stone Co., northeast of Ponca City, quarried and crushed limestone. Near Blackwell, sand and gravel was produced by Midwest Concrete Supply Co. and Blackwell Sand & Gravel Co. Other producers were Tonkawa Sand & Gravel Co.

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and Otoe Sand & Gravel Co. Contractor-crushed limestone was also produced for highways. Exploratory drilling resulted in the discovery of 10 oil wells and 1 gas well.

Kingfisher.—Construction sand and gravel was produced from pits near Dover by Dolese Bros. Co. Petroleum and natural gas were produced from three fields: Cashion-Northwest, Dover-Southwest, and Edmond-West.

Kiowa.—Dimension granite was quarried near Snyder by Century Granite Co. and Roosevelt Granite Co. Near Mountain Park, granite was quarried by J. P. Gilman Granite Co. Crushed granite also was produced. Construction sand and gravel was produced by Lugert Sand & Gravel Co. and Southwest Sand Co. Petroleum and natural gas were produced from nine fields. One oil-discovery well was drilled.

Latimer.—Coal was strip-mined by Cedar Creek Coal Co. and Kinta Stripping Co. and mined underground by Askew Coal Co., Floyd Newman, Louis Rouviere, and Strictland Coal Co. Natural gas was produced from the Red Oak and Morris fields.

Le Flore.—Coal was mined by 14 operators; 4 used strip mining, the rest underground mining. The county was the second-ranking coal producer in the State. Crushed sandstone was produced by Dixie Material Co., Inc.; contractor's sand and gravel was produced for highway surfacing. Natural gas was produced mainly from three fields. A gas-discovery well was drilled in the vicinity of the Cedars field.

Lincoln.—Petroleum and natural gas were produced from 71 fields; East Payson field produced about 1,117,000 barrels in 1954. Natural-gas liquids were produced by Highway Gasoline Co., The Texas Co., Magnolia Petroleum Co., and Moran Gasoline Corp. Extensive exploratory drilling in the county resulted in the discovery of 12 oil wells and 1 gas well. Crushed sandstone was produced for highways.

Logan.—Petroleum and natural gas were produced from 41 fields, and natural-gas liquids were recovered by the Eason Oil Co. Six exploratory wells proved oil-productive. Construction sand was produced by John McConnel and Dolese Bros. Co.

Major.—Petroleum and natural gas were produced from the Ringwood and Seiling-Northeast fields. Natural-gas liquids were recovered by Warren Petroleum Co. at Ringwood. Two oil-discovery wells were drilled. Construction sand and gravel was produced near Cleo Springs by Orin sand pit and Concho Sand & Gravel; other sand and gravel was produced for highways.

Marshall.—Petroleum was produced from 6 fields; Cumberland field supplied 1.7 million barrels. Natural-gas liquids were recovered by Warren Petroleum Corp. and Universal Gasoline Co. Sulfur from waste sour gas was recovered by Joe L. Parker plant east of Madill.

McClain.—Petroleum and natural gas were produced from 27 fields, and exploratory drilling resulted in the discovery of 3 oil wells. Sand and gravel was produced for highways.

McIntosh.—Coal was strip-mined by Braudrick Coal Co., Leavell Coal Co., and White Coal Co. Petroleum and natural gas were produced from the Coalton and Morris fields. Sand and gravel was produced for highways.

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Murray.—Asphaltic limestone and sandstone were produced near Dougherty by Southern Rock Asphalt Co. Limestone was crushed at Rayford and Big Canyon quarries of Dolese Bros. Co., and construction gravel was produced by Makins Sand & Gravel Co. near Dougherty. Glass sand was produced by Oklahoma Glass Sand Corp. Petroleum was produced from the Sulphur-Northwest field.

Muskogee.—Petroleum and natural gas were produced from 12 fields. Sand and gravel was pumped from the Arkansas River north of Muskogee by Yahola Sand & Gravel Co., and contractor sand and gravel was produced by the city of Muskogee. Limestone was crushed for highways. Coal was mined underground by Hicks Coal Co; it was strip-mined by McKee Coal Co., Cook Coal Co., and Crabtree Coal Co.

Noble.—Petroleum and natural gas were produced from 27 fields, and natural-gas liquids were recovered by Lucien Unit plant of the Gasoline Plant Management Co. Sand and gravel was produced by the Noble County Highway Department. Seven oil-discovery wells were completed.

Nowata.—Petroleum and natural gas were produced from six fields. Crushed limestone was produced by Peerless Rock Co. Exploratory drilling resulted in the discovery of three oil wells.

Okfuskee.—Petroleum and natural gas were produced from 72 fields; the Olympic field supplied about 4 million barrels of oil. Natural-gas liquids were recovered by two plants of C. W. and C. H. Grimes. Three oil-discovery wells and one gas-discovery well were drilled.

Oklahoma.—Petroleum and natural gas were produced from 23 fields; Oklahoma City and West Edmond fields each had oil production that exceeded 1 million barrels. Natural-gas liquids were recovered by Patton & Swab, Inc., Phillips Petroleum Co., and Cities Service Oil Co. Clay was obtained from pits in the west part of Oklahoma City by Acme Brick Co. and United Brick & Tile Co. for manufacturing brick and tile. Near Choctaw clay for lightweight aggregate was produced by Oklahoma Lightweight Aggregate Co. Construction sand was produced by Dolese Bros. Co.; north of Oklahoma City, construction sand and gravel was produced by Murphy & Perkins Sand Co. and Sizemore Sand & Gravel Co.; east of Oklahoma City. Paving sand was produced by Vinsonite Sales Co. and H. & T. Service Co. Other sand and gravel was produced by the State highway department. Six oil-discovery wells were completed.

Okmulgee.—Coal was mined near Henryetta by Starr Coal Co., Atlas Coal Corp., Ben Hur Coal Co., and McGinnis & Grafe, Inc. Petroleum and natural gas were produced from 27 fields, and natural-gas liquids were recovered by Phillips Petroleum Co. Two oil-discovery wells were drilled. A dimension-sandstone quarry was operated near Henryetta by Ada Stone Co. Sand and gravel was produced for highways.

Osage.—Osage, the fourth-ranking oil-producing county, produced oil and gas from 127 fields. The Burbank field, with a production of about 3.4 million barrels of oil, remained the most important. Natural-gas liquids were recovered by Phillips Petroleum Co., Skelly Oil Co., Neal Gasoline Co., and Sunray Oil Corp. Limestone was quar-

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ried and crushed east of Burbank by Burbank Rock Co. Nine exploratory wells proved oil-productive.

Ottawa.—Ninety-six operating mines in Ottawa County supplied the total Oklahoma lead and zinc output and a major part of the Tri-State district output. Chat, a byproduct of zinc and lead milling, was supplied by four producers. Tripoli quarried in east central Ottawa County by American Tripoli Co. was processed in its plant at Seneca, Mo. One oil well was brought in.

Pawnee.—Petroleum and natural gas were produced from 28 fields, and natural-gas liquids were recovered by Frame Natural Gasoline Co. Construction sand and gravel was produced by Osage Sand Co. near Cleveland, Ralston Sand Co. near Ralston, Tulsa Sand Co., and Means sand pit. Exploratory drilling resulted in the discoveries of 1 oil-producing well and 1 gas-producing well.

Payne.—Petroleum and natural gas were produced from 71 fields. Yale-Quay field, with a yearly production of 1.7 million barrels of oil, was the largest in the county. Natural-gas liquids were recovered by Mid Continent Petroleum Corp. near Stillwater. Sand and gravel was produced by the county highway department; crushed limestone was produced by the State highway department. Four oil-discovery wells and one gas-discovery well were drilled.

Pittsburg.—Pittsburg County ranked third in coal production. Coal was mined underground by Lone Star Steel Co., McAlester-Alderson Coal Co., Vinson & Vinson Coal Co., Bishop Coal Co., and 42 Coal Co. and strip-mined by R. E. and W. W. Lee. Natural gas was produced from three fields near Quinton. Sand and crushed limestone were produced for highway construction. Clay for manufacturing brick and tile was produced by the Oklahoma State Penitentiary west of McAlester.

Pontotoc.—Petroleum and natural gas were produced from 23 fields, and natural-gas liquids were recovered by Carter Oil Co. and Kerr-McGee Oil Industries, Inc. Building limestone was quarried near Fittstown by the Townsend Quarry, and shale and limestone were quarried near Lawrence by Ideal Cement Co. for use in its plant at Ada. Molding sand was produced by Grade A Sand & Gravel Co. and glass sand by Mid-Continent Glass Sand Co. Light-burning clay was produced east of Ada by Ada Brick Co. and Frankhoma Pottery Co. Red-burning clay was produced at Ada by Ada Brick Co. The drilling of 18 exploratory wells resulted in the discovery of 2 oil pools.

Pottawatomie.—Petroleum and natural gas were produced from 68 fields, of which St. Louis field was the largest. Natural-gas liquids were recovered by the plants of Warren Petroleum Co. and the Sinclair Oil & Gas Co. One oil-discovery well was drilled.

Rogers.—Coal was strip-mined by McNabb Coal Co. and Rogers County Coal Co. Petroleum and natural gas were produced from three fields; Chelsea district furnished most of the oil produced. Four oil-discovery wells and one gas-discovery well were drilled.

Seminole.—Petroleum and natural gas were produced from 76 fields; Seminole City field, with a yearly production of about 1 million barrels of oil, was the most important. Natural-gas liquids were recovered by the plants of Carter Oil Co., Sinclair Oil & Gas Co., and Phillips Petroleum Co. Clay was obtained west of Wewoka for manufactur-

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ing brick and tile by Wewoka Brick & Tile Co. Exploratory drilling resulted in the discovery of two oil wells.

Sequoyah.—Coal was mined underground by Fall River Mining Co. and strip-mined by Sallisaw Stripping Co. and Sallisaw Mining Co. Limestone was crushed north of Marble City at the quarry of Marble Stone Co. Part of the limestone crushed at Marble City was burned at Sallisaw in the kilns of St. Clair Lime Co. Dimension sandstone was quarried by one producer. Natural gas was produced from a small field, and exploratory drilling resulted in the discovery of one gas well.

Stephens.—The county ranked first in petroleum production. Petroleum and natural gas were produced from 38 fields; North Alma, Milroy, Sholem-Alechem, Velma, and Woolsey each had a production of more than 1 million barrels of oil. Natural-gas liquids were recovered by Magnolia Petroleum Co. and Skelly Oil Co. At the Duncan refinery of Sunray Oil Corp., a new 5,000-barrel-per-day Platformer was placed in operation. Sand and gravel was produced for highways. Nine exploratory wells proved oil-productive.

Texas.—Natural gas, from the vast Hugoton gas field, and petroleum were produced during the year. Natural-gas liquids were recovered in the vicinity of Guymon by Cities Service Oil Co., Panoma Corp., and Hugoton Plains Oil & Gas Co. Four oil-discovery wells and eight gas-discovery wells were drilled. Construction sand and gravel was produced north and south of Guymon by Stewart Bros.

Tulsa.—Petroleum and natural gas were produced from 23 fields, and natural-gas liquids were recovered by Pioneer Corp. near Bixby. Coal was mined underground east of Tulsa by Acme Coal Co. Clays for brick were produced by the Acme Brick Co. and United Brick & Tile Co., Tulsa, and by United Brick & Tile Co., Collinsville. East of Tulsa near Garnett, crushed limestone was produced by Acme Materials Co., Anchor Stone Co., and Chandler Materials Co. Construction sand was produced near Jenks by Bagby-Harris Co. Near Sand Springs sand was produced by Arkansas River Sand Co. and Sand Springs Sand Co. Near Tulsa, construction sand was produced by Acme Materials Co., Bagby-Harris Co., Chandler Materials Co., McMichael Concrete Co., Smith Sand Co., Young Materials Co., and Tulsa Sand Co. Crushed sandstone and sand also were produced by the State highway department. Expanded perlite was produced at the Tulsa plant of Ozark-Mahoning Co. Mid Continent Petroleum Corp. placed in operation a new 7,500-barrel catalytic reformer at its West Tulsa refinery. Also, expansion of its alkylation unit from 1,700 to 2,200 barrels per day was underway.

Washington.—Petroleum and natural gas were produced from five districts. Limestone and clay were quarried near Dewey for the manufacture of portland cement by Dewey Portland Cement Co. Part of the limestone quarried at Dewey was marketed as crushed limestone. Crushed stone also was produced near Bartlesville by Matoako Stone Co. New installations at the Dewey Portland Cement Co. plant included a 10- by 18-foot tube mill, dust collectors on the rock driers, a coal drier, and enlarged facilities to permit more electric power. Two oil-discovery wells were drilled.

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Woods.—Construction sand and gravel was produced near Waynoka by Waynoka Sand & Gravel Co. Salt was produced west of Freedom by Ezra Blackmon. Petroleum and natural gas were produced from one field, and exploratory drilling resulted in the discoveries of three oil wells.

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The Mineral Industry of Oregon

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, United States Department of the Interior, and the Oregon State Department of Geology and Mineral Industries.

By Kenneth D. Baber,[1] Frank B. Fulkerson,[1] and Albert J. Kauffman, Jr.[2]

ALTHOUGH metal mining was important in many localities in Oregon, the State's mineral production in 1954 consisted largely of stone, sand and gravel, clays, and other nonmetallic commodities produced for direct use in the construction industry or used in manufacturing such building materials as cement, building blocks, lightweight aggregate, and brick and tile. Of the apparent increase of $7.8 million in total value of mineral production in 1954, $3.5 million resulted from better statistical coverage of the commercial sand and gravel industry. Through cooperation of the industry, the sand and gravel mailing list was expanded greatly in 1954. Much of the remaining increase in value was explained by the volume of output of Government-and-contractor sand and gravel, and stone and cement due to increased demand in public construction on roads, buildings, and dams. Private building also was at a high level but was less than in 1953 because of a 12-week strike in the Douglas-fir industry in the summer, which brought idleness due to strikes to an alltime peak and adversely affected the economy of the entire State. Another factor in the increased mineral value was the production of nickel ore for the first time from a deposit in Douglas County, where a multimillion-dollar plant to produce ferronickel was being completed. The output of chromite ore in Oregon and the production of shale for use by the expanded-shale operators in the Portland area also increased.

Some production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with Bureau of the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

Interest in petroleum reached a new high in Oregon during the latter part of 1954. As a result of the sudden surge in land leasing, it was estimated that over half of the million acres of Government land in the State and probably as much private land were under lease. Major companies that have indicated interest include: Sinclair Oil & Gas Co., Richfield Oil Co., Standard Oil Co. of California, Humble Oil Co., The Texas Co., and El Paso Natural Gas Co.

Agreement was reached late in the year to supply natural gas to the Pacific Northwest from the San Juan Basin in New Mexico and

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TABLE 1.—Mineral production in Oregon, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Chromite—gross weight	6,216	$484,453	6,655	$537,928
Clays	292,445	296,050	(2)	(2)
Copper (recoverable content of ores, etc.)	9	5,166	5	2,950
Gold (recoverable content of ores, etc.)—fine ounces	8,488	297,080	6,520	228,200
Lead (recoverable content of ores, etc.)	5	1,310	5	1,370
Manganese ore (35 percent or more Mn)—gross weight	46	(2)		
Manganiferous ore (5 to 35 percent Mn)—do	271	(2)		
Mercury—76-pound flasks	648	125,083	489	129,287
Nickel ore (nickel content)			1,993	(2)
Pumice and pumicite	73,080	173,822	67,852	177,515
Sand and gravel	8,763,078	8,629,632	13,157,239	14,149,380
Silver (recoverable content of ores, etc.)—fine ounces	12,259	11,095	14,335	12,974
Stone	[3] 4,939,080	[3] 6,301,639	5,872,353	8,617,795
Undistributed: Carbon dioxide, cement, diatomite, gem stones, crushed granite (1953), crude iron oxide pigment materials (1954), crude perlite (1953), tungsten concentrate, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2). Excludes value of clays used for cement in 1953		8,123,493		10,172,067
Total		24,449,000		[4] 32,268,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Value included with "Undistributed."
[3] Excludes certain stone, value for which is included with "Undistributed."
[4] The total has been adjusted to eliminate duplication in the value of clays and stone.

Colorado and from the Peace River field in north-central British Columbia. According to the announcement, pipelines from both areas would be interconnected at the Canadian border near Vancouver. Initial deliveries of natural gas from these fields was scheduled to begin in 1956.

According to the Oregon Unemployment Compensation Commission, Oregon's mining industries employ a relatively small number of workers—about 1,200. This number has remained the same for at least the last 10 years (table 2). Nonmetallic mining and quarrying account for 88 percent of employment and metal mining only 12 percent. Compared with total industrial activity in the State, mining is less important than in the other three Pacific Northwest States—Washington, Idaho, and Montana. Also, it appears to be more seasonal, being made up in large part of production of raw materials for the construction industry, which in turn is the most seasonal of all nonagricultural industries in Oregon.

Mining payrolls have increased from an average of $3.5 million in 1945–49 to $5.3 million in 1954. Dividing total wages each year by the average number of employees gives a rough approximation of the increase in the annual wage level in the industry. This wage level increased from $3,115 for 1945–49 to $4,487 in 1954, a gain of 44 percent.

Median earnings of employees in mining are estimated by the Oregon Unemployment Compensation Commission. The median is the division of workers with half earning more than the median and half earning less. In 1954 median earnings amounted to only $2,167.

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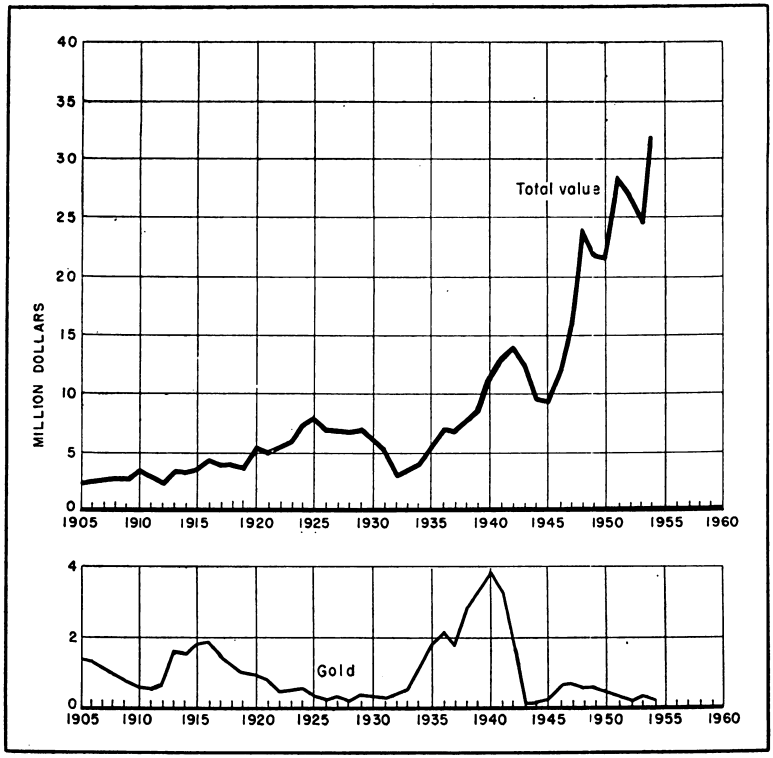

FIGURE 1.—Value of mineral production in Oregon, 1905–54.

Labor turnover was the main factor reducing the annual wage income per worker.

Employment in primary metals plants in Oregon totaled 3,328, nearly three times the number of workers in mining, and payrolls totaled over $16 million. Dividing the payroll figure by the average number of workers gives an approximate wage level of $4,900, compared with $4,487 in mining.

Estimates of weekly earnings of production workers (excluding administrative, supervisory, technical, and office personnel) are prepared by the State Unemployment Compensation Commission in cooperation with the United States Bureau of Labor Statistics. Average weekly earnings in primary and fabricated metals rose to a new high of $86.70 in 1954. These earnings are substantially above the national average. Table 3 summarizes trends in average weekly hours and earnings for Oregon and the United States in metals.

Primary metals (3,328 employees), stone and clay products (1,275), petroleum and coal products (406), and industrial chemicals (428) collectively employ 5,437 people or 4 percent of all Oregon manufacturing employment.

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TABLE 2.—Average number of employees, payrolls, and earnings of employees in mining firms subject to State Unemployment Compensation Act, 1945–49 (average) and 1950–54 [1]

Year	Average number of employees	Total payrolls	Approximate wage level	Median earnings
1945–49 (average)	1,137	$3,542,073	$3,115	$1,907
1950	1,224	4,519,730	3,693	1,900
1951	1,250	5,032,565	4,026	2,450
1952	1,176	4,999,464	4,251	1,960
1953	1,202	5,307,721	4,416	2,383
1954	1,182	5,304,031	4,487	2,167

[1] Data for average number of employees, total payrolls, and median earnings were compiled from Oregon Unemployment Compensation Commission bulletins. Approximate wage-level figures represent division of total payrolls by figures for average number of employees.

TABLE 3.—Average weekly hours and earnings for Oregon and the United States in metal industries, 1950–54 [1]

Year	Oregon		United States			
	Primary and fabricated metals		Primary metals		Fabricated metals	
	Average weekly earnings	Average weekly hours	Average weekly earnings	Average weekly hours	Average weekly earnings	Average weekly hours
1950	$71.01	40.8	$67.24	40.8	$63.42	41.4
1951	75.66	39.6	75.12	41.5	68.81	41.7
1952	78.93	39.6	77.33	40.7	72.38	41.6
1953	83.79	39.3	84.25	40.9	77.15	41.7
1954	86.70	39.0	80.88	38.7	77.33	40.7

[1] State Unemployment Compensation Commission data.

TABLE 4.—Employment and payrolls in mineral-manufacturing industries, 1954 [1]

Industry	Average number of employees	Total payrolls
Primary metals	3,328	$16,333,863
Stone and clay products	1,275	5,523,171
Products of petroleum and coal	406	1,914,165
Industrial chemicals	428	1,960,152

[1] State Unemployment Compensation Commission data.

In transporting mineral products there has been an increase in barge traffic up the Columbia River from Portland to points in eastern Oregon and Washington. In 1954, cement, gasoline and other petroleum products, and anhydrous ammonia were barged upstream to points as far east as Pasco, Wash. With completion of The Dalles Dam, now under construction, and other hydroelectric projects at present in the planning stage, the capacity of the Columbia River as an inland waterway will be increased further, and barge service eventually may be extended as far as Lewiston, Idaho, on the Snake River.

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Defense Minerals Exploration Administration.—During 1954 the program of the Defense Minerals Exploration Administration (DMEA) continued to encourage systematic investigation of strategic and critical mineral occurrences. In Oregon three projects at mercury properties were active.

TABLE 5.—Defense Minerals Exploration Administration contracts active during 1954

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
CROOK					
John McManmon	Pinkey No. 1 and No. 2.	Mercury	Oct. 7, 1954	$9,433	75
DOUGLAS					
Bonanza Oil & Mine Corp.	Bonanza	do	June 2, 1953	50,056	75
GRANT					
Lawrence H. Roba and Delbert V. Westfall.	Beaver and Purple Ridge.	do	do	20,140	75

REVIEW BY MINERAL COMMODITIES

METALS

Aluminum.—Production of aluminum metal from alumina imported into the State continued throughout the year at the Reynolds Metals Co. Troutdale plant in Multnomah County. This plant was one of the six active aluminum-reduction operations located in the Pacific Northwest primarily because of the availability of low-cost hydroelectric power. The Pacific Northwest aluminum-reduction industry was the subject of a report issued during the year.[3] This report, which traces development of the industry in the Pacific Northwest since its inception in 1940 and gives much detailed information on the industry's effect on the economy of the region states:

> For every Northwest worker who received his paycheck directly from one of the three aluminum producers in 1952 (7,600 employees during that year), the income of three other workers was directly traceable to the Northwest aluminum industry.

Construction work on the National Metallurgical Corp. pilot plant at Springfield in Lane County was completed early in the year. Output from the $400,000 plant during 1954 included both silicon metal and aluminum-silicon alloy. Operations were directed toward perfecting the process for direct smelting of aluminum-bearing clays to produce aluminum-silicon alloy. Reports stated that briquetted lampblack from Portland, silica from near Rogue River, and hoggedwood waste from local sawmills were being utilized. The direct smelting process being perfected at the plant was developed at the Federal Bureau of Mines Northwest Electrodevelopment Experiment Station at Albany.

[3] Green, Carleton, The Impact of the Aluminum Industry on the Economy of the Pacific Northwest. Report by Stanford Research Institute, prepared for Aluminum Co. of America, June 1954, 71 pp.

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Experimental work in Salem, Marion County, at the former Government alumina-from-clay plant was conducted by Harvey Machine Co. during the year. The company purchased the plant from the Government in 1953. Early reports indicated possible successful production of alumina from laterite deposits near Salem.

Although no activity was reported at the Harvey Machine Co. proposed aluminum-reduction plant site near The Dalles during 1954, a news service report stated late in June that company officials were ready to proceed with the project when electrical power requirements were assured. Regular congressional appropriation bills enacted in June did not provide for the funds required for constructing necessary power-transmission facilities by Bonneville Power Administration (BPA).

Chromium.—Chromium production in Oregon in 1954 increased 7 percent in quantity and 11 percent in value over 1953. The output, as measured by mine shipments, was only slightly more than in 1952, when 6,600 short tons was produced.

As in preceding years, the major portion of the Oregon production totals was derived from operations in Josephine County. Grant County ranked second and Curry County third. Josephine County output was somewhat less than in 1953, but gains were registered in all other counties. The total number of chrome-mining operations in the State declined somewhat from 1953. Major producers included J. R. Holman and B. A. & R. E. McCaleb in Curry County; Burt Hayes and the John Day Mining Co. (Arthur F. Neuman) in Grant County; and D. W. Bowers, J. N. Grissom and Joe Inman, King & Hansen Mining Co., Fred Langley, Wm. S. Robertson, Tulare Bros. Mining Co., and Waldo Milling Co. in Josephine County.

Purchases of chrome ore by the General Services Administration (GSA) at the stockpile depot in Grants Pass through December 1954 totaled 86,687 short tons. Purchase of 224,000 short tons has been authorized, and the program will terminate when this goal is reached or on June 30, 1957, whichever occurs first.

TABLE 6.—Shipments of chromite ore and concentrate in 1954

County	Number of operations reported	Value		Short tons, gross weight		
		1953	1954	45 percent or more Cr_2O_3	Less than 45 percent Cr_2O_3	Total
Coos		$1,528				
Curry	8	64,947	$94,619	1,051	30	1,081
Douglas	5	15,576	19,803	199	64	263
Grant	3	91,510	(1)	(1)	(1)	(1)
Jackson	3	(1)	6,134	36	32	68
Josephine	19	292,007	257,765	2,303	952	3,255
Unassigned [2]	5	18,885	159,607	1,936	52	1,988
Total	43	484,453	537,928	5,525	1,130	6,655

[1] Included with unassigned to avoid disclosure of individual operations.
[2] In addition to data under footnote 1, includes value and production figures for operations for which county locations were not determined.

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Plans for utilizing the 55,000-ton chromium-concentrate stockpile accumulated during World War II by Metals Reserve Corp., a Government operation, at Coquille, Coos County, materialized late in the year. Pacific Northwest Alloys, Inc., of Mead, Wash., began work on a $150,000 plant that would upgrade the stockpiled concentrate from about 25 percent to about 40 percent Cr_2O_3. According to the contract between the company and the GSA, the upgraded concentrate was to be shipped to the former Mead magnesium plant (near Spokane, Wash.), which was leased by Pacific Northwest Alloys, Inc., from the Government in 1953. There the concentrate would be processed into low-carbon ferrochrome.

Also in Coos County, the Mineral Sands Co. of Lansing, Mich., revealed plans for a large, open-pit, chrome-mining operation. According to reports, the company planned to mine and process coastal black-sand deposits near Coquille. A newly developed process that made extraction of chrome from the sands commercially feasible was to be used.

Copper.—Five tons of copper valued at $3,000 was produced. Ray E. Summers made a shipment of copper ore from the Standard mine, near Prairie City, Grant County, early in the year, and copper-bearing gold ore was shipped from the Buffalo mine, also in Grant County.

Gold.—Production of gold dropped very low as a result of suspension of bucketline dredging operations by the Powder River Dredging Co. at the Sumpter Valley placers in Baker County. The Powder River Co. had been the only large-scale gold producer in Oregon since 1951. The quantity of gold recovered in the State was the lowest on record, except for 1943–45, when the principal mines were closed by a War Production Board order, and 1952. Although Oregon does not rank as a major producer among the Western States in total quantity of gold recovered since the first discoveries, gold mining in the State has been of considerable importance in past years. As late as 1940 about 110 lode mines and nearly 200 placers were active, and in that year production reached an alltime high of 113,400 ounces, with a value of $4 million. Following the collapse of the domestic gold-mining industry during World War II, production at some mines in Oregon was resumed, but increasing costs, the fixed price for gold and silver, and depletion of high-grade reserves led to an almost continuous decline in output after 1947. The shutdown of the bucketline dredge in Baker County probably will mean that production in the State will drop to less than 2,000 ounces a year.

TABLE 7.—Mine production of gold and silver in 1954, by months, in fine ounces of recoverable metals

Month	Gold	Silver	Month	Gold	Silver
January	350	110	August	420	1,410
February	780	200	September	230	60
March	980	330	October	350	1,800
April	800	200	November	200	500
May	690	1,070	December	260	2,275
June	950	4,140			
July	510	2,240	Total	6,520	14,335

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TABLE 8.—Mine production of gold, silver, copper, lead, and zinc, 1945–49 (average), 1950–54, and total, 1852–1954, in terms of recoverable metals [1]

Year	Mines producing [2]		Material sold or treated [3] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945–49 (average)	21	33	3,447	14,376	$503,167	14,712	$12,774
1950	32	42	4,257	11,058	387,030	13,565	12,277
1951	14	31	1,495	7,927	277,445	6,218	5,628
1952	13	25	931	5,509	192,815	4,037	3,654
1953	8	21	1,215	8,488	297,080	12,259	11,095
1954	20	26	2,916	6,520	228,200	14,335	12,974
1852–1954	----------	----------	(4)	5,780,870	130,293,493	5,331,896	4,890,898

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	9	$3,433	7	$2,073	2	$392	$521,839
1950	19	7,904	17	4,590	21	5,964	417,765
1951	11	5,324	2	692	3	1,092	290,181
1952	1	484	1	322	1	332	197,607
1953	9	5,166	5	1,310	----------	----------	314,651
1954	5	2,950	5	1,370	----------	----------	245,494
1852–1954	12,424	4,677,019	809	94,819	173	23,194	139,979,423

[1] Includes recoverable metal content of gravel washed (placer operations), old tailings re-treated, ore milled, and ore shipped to smelters during calendar year indicated.
[2] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[3] Does not include gravel washed.
[4] Figure not available.

It was reported that the Powder River Dredging Co. discontinued work in Sumpter Valley because the company could not obtain new placer ground in the area. About 30 men were employed at the dredge. The operation was begun in 1935 by Sumpter Valley Dredging Co., which installed a Yuba-electric bucketline dredge, and, after a closure during World War II, was continued by the successor companies—Baker Dredging Co. in 1948 and Powder River Dredging Co. in 1950. Throughout the 20-year period the dredge produced more gold than any other placer operation in the State and also exceeded all lode mines except from 1939 to 1941, when the now idle Cornucopia lode mine in Baker County was the largest producer. Since 1951 the dredge, which was equipped with seventy-two 9-cubic foot buckets, was the only one of the bucketline type still in operation in Oregon. In 1954 the dredge washed 1,382,000 cubic yards of gravel, which averaged 12 cents per yard in gold and silver values.

Of the gold recovered from placers in the State during the year, 94 percent was produced by bucketline dredging, 3 percent by hydraulic mining, 1 percent by nonfloating washing plants, and the remaining

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TABLE 9.—Gold produced at placer mines, 1945–49 (average) and 1950–54, by classes of mines and methods of recovery

Class and method	Mines producing [1]	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	Average value per cubic yard
Surface placers:					
Gravel mechanically handled:					
Bucketline dredges:					
1945–49 (average)	3	3,573,160	9,842	$344,470	$0.096
1950	2	3,051,000	7,827	273,945	.090
1951	2	2,719,900	6,775	237,125	.087
1952	1	2,548,700	4,571	159,985	.063
1953	1	2,176,000	6,935	242,725	.112
1954	1	1,382,000	4,685	163,975	.119
Dragline dredges: [2]					
1945–49 (average)	6	466,730	2,433	85,162	.182
1950	3	101,000	446	15,610	.155
1951	1	6,500	47	1,645	.253
1952	1	5,000	27	945	.189
1953					
1954	1	3,000	11	385	.128
Nonfloating washing plants: [3]					
1945–49 (average)	3	26,560	239	8,365	.314
1950	5	8,300	40	1,400	.169
1951					
1952	1	(4)	5	175	
1953					
1954	2	2,610	44	1,540	.059
Gravel hydraulically handled:					
1945–49 (average)	13	74,520	314	10,976	.147
1950	21	83,300	472	16,520	.198
1951	11	16,550	115	4,025	.243
1952	9	27,600	147	5,145	.186
1953	9	27,500	209	7,315	.266
1954	16	101,300	170	5,950	.058
Small-scale hand methods: [5]					
1945–49 (average)	7	11,720	159	5,551	.474
1950	10	3,200	229	8,015	2.505
1951	5	9,850	207	7,245	.736
1952	13	15,200	146	5,110	.336
1953	10	9,800	138	4,830	.493
1954	[6] 5	12,400	60	2,100	.169
Underground placers (drift):					
1945–49 (average)	1	320	7	252	.788
1950	1	400	8	280	.700
1951	2	800	20	700	.875
1952					
1953	1	450	7	245	.547
1954	1	80	22	770	9.63
Grand total placers:					
1945–49 (average) [7]	33	4,156,010	13,025	455,861	.110
1950	42	3,247,200	9,022	315,770	.097
1951	21	2,753,600	7,164	250,740	.091
1952	25	2,596,500	4,896	171,360	.066
1953	21	2,213,750	7,289	255,115	.115
1954	26	1,501,390	4,992	174,720	.116

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[2] Includes all placer operations using dragline excavator for delivering gravel to floating washing plant.
[3] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."
[4] Data not available.
[5] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, etc. "Wet" method used exclusively in Oregon.
[6] Includes suction dredge, for which Bureau of Mines is not at liberty to disclose output.
[7] Includes 31 ounces of gold from suction dredges, valued at $1,085.

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TABLE 10.—Mine production of gold, silver, copper, and lead in 1954, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer [1]	Fine ounces	Value	Fine ounces	Value
Baker	7	5	5,164	$180,740	1,398	$1,265
Douglas		3	35	1,225	2	2
Grant	3	2	1,051	36,785	12,882	11,659
Jackson	7	8	194	6,790	44	40
Josephine	2	6	43	1,505		
Union and Wheeler [2]	1	2	33	1,155	9	8
Total	20	26	6,520	228,200	14,335	12,974

County	Copper		Lead		Total value
	Pounds	Value	Pounds	Value	
Baker					$182,005
Douglas					1,227
Grant	10,000	$2,950	10,000	$1,370	52,764
Jackson					6,830
Josephine					1,505
Union and Wheeler [2]					1,163
Total	10,000	2,950	10,000	1,370	245,494

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[2] Combined to avoid disclosure of individual output.

TABLE 11.—Mine production of gold, silver, copper, and lead in 1954, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines	Material sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Lode ore:						
Dry gold	16	845	513	173		
Dry gold-silver	1	2,004	1,002	12,815	2,200	10,000
Copper	1	44	8	61	7,800	
Total	18	2,893	1,523	13,049	10,000	10,000
Other lode material: Old tailings (gold)	2	23	5			
Total lode material	20	2,916	1,528	13,049	10,000	10,000
Gravel (placer operations)	26	(1)	4,992	1,286		
Total, all sources	46	2,916	6,520	14,335	10,000	10,000

[1] 1,501,390 cubic yards.

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TABLE 12.—Mine production of gold, silver, copper, and lead in 1954, by methods of recovery, and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Lode:				
Amalgamation:				
Ore	246	50	----------	----------
Old tailings	5	----------	----------	----------
Concentration, and smelting of concentrates	1,265	12,935	2,200	10,000
Direct smelting	12	64	7,800	----------
Total	1,528	13,049	10,000	10,000
Placer	4,992	1,286	----------	----------
Grand total	6,520	14,335	10,000	10,000

TABLE 13.—Mine production of gold, silver, copper, and lead in 1954, by counties and districts, in terms of recoverable metals

County and district	Mines producing[1]		Lode material (short tons)	Gold (lode and placer)[2] (fine ounces)	Silver (lode and placer)[3] (fine ounces)	Copper (pounds)	Lead (pounds)	Total value
	Lode	Placer						
Baker County:								
Sumpter	----------	1	----------	4,690	1,253	----------	----------	$165,284
Virtue	1	----------	60	56	3	----------	----------	1,963
Weatherby	----------	1	----------	34	----------	----------	----------	1,190
Other districts[4]	6	3	650	384	142	----------	----------	13,568
Douglas County: Riddle and Umpqua (Wolf Creek)[5]	----------	3	----------	35	2	----------	----------	1,227
Grant County:								
Canyon	1	----------	60	22	3	----------	----------	737
Granite	1	----------	2,004	1,002	12,815	2,200	10,000	48,687
North Fork	----------	1	----------	6	1	----------	----------	211
Quartzburg	1	----------	44	8	61	7,800	----------	2,636
Susanville	----------	1	----------	13	2	----------	----------	457
Jackson County:								
Gold Hill	1	3	8	21	2	----------	----------	773
Upper Applegate	6	5	23	173	42	----------	----------	6,093
Josephine County:								
Galice and Greenback[5]	2	5	17	36	----------	----------	----------	1,260
Grants Pass	----------	1	----------	3	----------	----------	----------	105
Illinois River	----------	(6)	----------	4	----------	----------	----------	140
Other districts[7]	1	2	50	33	9	----------	----------	1,163
Total Oregon	20	26	2,916	6,520	14,335	10,000	10,000	245,494

[1] Excludes itinerant prospectors, "snipers," "high-graders," and others who gave no evidence of legal right to property.
[2] Source of gold: 1,528 ounces from lode mines and 4,992 ounces from placers.
[3] Source of silver: 13,049 ounces from lode mines and 1,286 ounces from placers.
[4] Includes Baker, Burnt River, Connor Creek, Cracker Creek, Eagle Creek, Greenhorn, and Sparta districts for which Bureau of Mines is not at liberty to publish separate figures.
[5] Combined to avoid disclosure of individual output.
[6] From property not classed as a mine.
[7] Includes Camp Carson district, Union County, and Spanish Gulch district, Wheeler County.

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2 percent by small-scale hand methods, drift mining, and dragline and suction dredging. The total production from placers declined 32 percent from 1953.

Although production from lode mines was small, output gained 27 percent in contrast to the decrease from placer operations, and the number of mines reporting production increased from 8 to 20. Boaz Mining Co. Buffalo mine in Granite district, Grant County, continued to be the largest producer. The company treated about 2,000 tons of ore in the Buffalo flotation mill and shipped gold-silver concentrate to the Tacoma, Wash., smelter. Greenhorn Mountain Development Co. began operations at the Pyx mine on the Baker-Grant County line in Greenhorn district after acquiring the property early in the year.

Placer mines supplied 77 percent of the gold produced in the State and lode mines 23 percent. About 79 percent of the total came from Baker County, 16 percent from Grant County, and the remainder from Douglas, Jackson, Union, and Wheeler Counties.

Iron Ore.—The results of investigations by the Federal Bureau of Mines into the utilization of low-grade iron ores in Columbia County were published during the year.[4]

Lead.—Gold ore shipped from the Buffalo mine contained a small quantity of recoverable lead. Oregon's production totaled 5 tons valued at $1,400.

Mercury.—The output of mercury in the State during 1954 was 489 flasks, a 25-percent decline from 1953. The total was the lowest since 1950, when only five flasks were produced. Despite the decline in output, there was a general increase in interest in mercury mining, and there were numerous reports of activity at various properties in the State due to a rise in price of the metal from a range of $187–$189 per flask in January to a high of $325–$330 per flask in October. Another factor was establishment by the Government of a mercury-purchasing program that guaranteed a price of $225 per flask through December 1957 or until 125,000 flasks of domestic mercury had been purchased. The seeming discrepancy between low mine output and high prices was due mainly to the time required to place a property in operation after price rises made extraction and treatment of the ore economically feasible. The higher average price for the year accounted for the slight gain in value of output over 1953.

As in the preceding years, a large part of the State's output came from the Bonanza Oil & Mine Corp. Bonanza mine near Sutherlin, Douglas County. Low prices in late 1953 and 1954 forced closure of the mine in February, but in June the mine was reopened. Other mercury producers included the Canyon Creek Mining Co. (Mother Lode mine), New Amity Mining Co. (New Amity mine), Ochoco Mining Co. (Ochoco mine before acquisition by New Amity Mining Co. in November), and Winter Creek Mining Co. (Winter Creek mine), all in Crook County. Small quantities also were reported from the Platner mine, Crook County; War Eagle mine, Jackson County; and Opalite No. 1 mine, Malheur County.

[4] Walsted, J. P., Metallurgical Tests on Scappoose (Oregon) Iron Ore: Bureau of Mines Rept. of Investigations 5079, 1954, 46 pp.

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In Jefferson County the Cordero Mining Co. began preliminary work directed toward reopening the Horse Heaven mine. Once a leading domestic producer, the mine was closed after a fire in 1944. DMEA projects were carried on at the Roba and Westfall Deer Creek mine in Grant County, at the Pinkey No. 1 and 2 claims in Crook County by John McManmon, and at the Bonanza mine in Douglas County by the Bonanza Oil & Mine Corp. Exploratory work was conducted by D. E. Glover at the Barnes Butte mine in Crook County, and by Bernard Young and Steve Cooper at the Maud S. mine in Douglas County.

Nickel.—Emphasis on activities at the Riddle nickel deposit in Douglas County by the M. A. Hanna Co. subsidiaries, Hanna Coal & Ore Corp. and Hanna Nickel Smelting Co., passed from construction to production during the year. The mining subsidiary, Hanna Coal & Ore Corp., reported production of nearly 125,000 short tons of ore containing 1.6 percent nickel, and news reports indicated that output by the smelting subsidiary, Hanna Nickel Smelting Co., was about 300,000 pounds of nickel contained in ferronickel. The multimillion-dollar project was operated under a Government contract which was to run through June 1962 and called for production of 95 to 125 million pounds of nickel as ferronickel.

A contract between Hanna Nickel Smelting Co. and the BPA was signed in May to provide power for the operation. The 20-year contract allowed for a maximum demand of 65,000 kilowatts. Power-transmission facilities were provided for under an agreement between the company and the California-Oregon Power Co.

Low-grade nickel deposits in Curry County were discussed in a report published in September.[5]

Silver.—Silver was produced in Oregon in 1954 as a byproduct of gold mining. The Buffalo lode mine in Grant County and the Powder River dredging operation in Baker County supplied nearly all of the silver recovered during the year.

Tungsten.—A small quantity of tungsten ore was shipped from Oregon to the United States Vanadium Co. in California during the year.

Zirconium.—Production of zirconium and hafnium sponge and ingots for the Atomic Energy Commission was continued throughout the year at Albany, Linn County, by the Bureau of Mines Northwest Electrodevelopment Experiment Station.

NONMETALS [6]

Asbestos.—The search for commercial serpentine asbestos continued. Canadian Johns-Manville Co. reportedly diamond-drilled claims on Josephine Creek, Josephine County.

Cement.—Output and shipments of cement from plants in Oregon increased about 6 percent over 1953; larger shipments and higher prices per barrel resulted in the value of total shipments increasing about 11 percent.

Oregon Portland Cement Co. operated a plant at Oswego Clackamas County; a plant and quarry at Lime, Baker County; and a

[5] Hundhausen, R. J., McWilliams, J. R., and Banning, L. H., Preliminary Investigation of the Red Flats Nickel Deposit, Curry County, Oregon: Bureau of Mines Rept. of Investigations 5072, 1954, 17 pp.
[6] Norman S. Petersen, Commodity-industry analyst, assisted in preparing this section.

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quarry near Dallas, Polk County. Ideal Cement Co., Pacific Division, operated its plant at Gold Hill, Jackson County, and the Marble Mountain quarry near Wilderville, Josephine County.

Clays and Shale.—Consumption of clays by the structural-clay-products industry declined about 12 percent below the 1953 level, but a 46-percent increase was reported by expanded-shale operators. Eighteen structural-clay-products plants and two expanded-shale plants were active. Although the value of raw clays and shale used at these plants usually has been less than $300,000 a year, these commodities annually represent a multimillion-dollar industry in term of product value.

Shale from deposits in Washington County was expanded at two plants for use as lightweight-concrete aggregate. This type of lightweight aggregate was used in constructing a hospital in Portland. According to a report, use of this concrete aggregate reduced the weight of the structure by about 3 million pounds.[7] Flowerpots and stoneware were manufactured by one plant in Portland from clays mined in Yamhill County. Heavy clay products, including building brick and tile, drain tile, and sewer pipe, were made at the other plants. Washington, Jackson, Multnomah, Baker, Clackamas, and Yamhill Counties furnished about 90 percent of the production. Other counties, in order of output, were Benton, Klamath, Malheur, Marion, Linn, Polk, Union, and Tillamook.

Diatomite.—Great Lakes Carbon Corp. continued to be the only producer of diatomite in Oregon. The output of the quarry and preparation plant at Terrebonne, Deschutes County, was about 12 percent less than 1953, due to a corresponding decrease in demand.

Investigation and exploration of diatomite deposits in southeastern Oregon were carried on by Great Lakes Carbon Co., Johns-Manville Co., and Malheur Wunder Earth, Inc. According to an article,[8] Malheur Wunder Earth, Inc., Vale, has made plans to mine a diatomite deposit in the Harper-Westfall area of Malheur County and to construct a processing plant near Harper. The product will be marketed by Tidewater Commercial Co., Portland.

Gem Stones.—Oregon continued to be a source of agates, "thunder eggs," and other silicified materials suitable for cutting and polishing. Mineral specimens and polished stones were sold by mineral dealers and curio shops.

Gypsum.—Cimota Enterprises, Inc., Boise, Idaho, began to develop the Malheur claims, an open-pit gypsum operation, in Malheur County. No shipments were made; developmental production was stockpiled. If developed commercially, this will be the first gypsum-producing mine in the State.

Lime.—Plans were made by Chemical Lime Co., Baker, Baker County, to build a lime-burning plant at Wing, 4 miles west of Baker. A high-grade limestone deposit on Marble Creek was being developed by the company.

Perlite.—There was no production of crude perlite during 1954; the processing facilities of Dant & Russel, Inc., at Dant, Wasco County, were purchased by Sunset Equipment Co. of Portland, and plans were made to dismantle the plant.

[7] Pit and Quarry, vol. 46, No. 11, May 1954, p. 224.
[8] Pit and Quarry, vol. 49, No. 9, March 1954, pp. 136-137.

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The Northwest Perlite Co., Portland, completed diamond-drilling a perlite deposit near Sheaville, Malheur County. Supreme Perlite Co., North Portland, Multnomah County, expanded perlite shipped from Pioche, Nev.

The expanded perlite was marketed throughout the Pacific Northwest and used as plaster aggregate, as insulation material in foundries, and as a filler material in fireproof paints.

Phosphate Rock.—Plans were announced by Hughes-Johnson Chemical Co., Portland, to construct a plant to produce superphosphate fertilizer from Idaho phosphate rock.

Pumice.—Output of pumice in Oregon declined about 7 percent compared with 1953. In contrast, there was a slight increase in value of output brought about by sales of larger quantities of prepared pumice. Three companies in Deschutes County and one in Harney County produced pumice for lightweight-concrete aggregate. Two companies in Redmond mined volcanic cinders. Most of this production was used as road ballast and asphaltic aggregate. Cinders are used also in building-block aggregate and for roofing granules. Large cinder rocks are suitable for landscaping and for retaining walls. A comprehensive review of lightweight-aggregate materials was published.[9]

Sand and Gravel.—A gross output of 13.2 million tons of sand and gravel valued at $14.1 million was distributed between commercial, 8.1 million tons ($8.8 million) and Government-and-contractor, 5.1 million tons ($5.4 million). Thirty-one counties reported production; counties having an output of more than 1 million tons were Lane, Multnomah, and Clackamas.

The apparent rise in commercial sand and gravel production (2.9 million tons) can be attributed entirely to better statistical coverage of the active operations as a result of the 1953 canvass and also to the excellent cooperation of the industry. Increased activities of Federal, State, and county agencies resulted in an advance of about 1.5 million tons in Government-and-contractor output.

An article was published covering the sand and gravel industry.[10]

Silica.—Output by Bristol Silica Co., Rogue River, Jackson County, the only silica producer in the State, was slightly above that in 1953. Silica from the deposit was used in manufacturing silicon carbide, silicon, aluminum-silicon alloy, and ferrosilicon; for filter, refractory, and abrasive purposes; for roofing granules; and for poultry grit.

Stone.—The gross output of stone (including stone used in the manufacture of cement) was 5.9 million tons valued at $8.6 million. Total production was divided between commercial, 2.7 million tons ($4.1 million), and Government-and-contractor, 3.2 million tons ($4.6 million). Basalt used for concrete and road ballast was the principal stone quarried. Limestone was sold for chemical, metallurgical, and agricultural purposes, and granite was ground for use as poultry grit. In several eastern Oregon counties, volcanic cinders were used for road ballast, asphaltic aggregate, building-block aggregate, and roofing granules. Thirty-one counties reported stone production.

[9] Chesterman, Chas. W., Lightweight Aggregates of the West: Min. Cong. Jour., vol. 40, No. 12, December 1954, pp. 67-69.
[10] Walker, Stanton, Merchandisable Sand and Gravel: Pit and Quarry, No. 5, May 1954, pp. 134-138, 150.

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TABLE 14.—Sand and gravel sold or used by producers in Oregon, 1953–54, by classes of operation and uses

	1953			1954			Percent change in—	
	Short tons	Value		Short tons	Value		Tonnage	Average value
		Total	Average		Total	Average		
COMMERCIAL OPERATIONS								
Sand:								
Molding				1,183	$6,980	$5.90		
Building	854,585	$909,250	$1.06	911,899	1,124,155	1.23	+7	+16
Road material	177,480	203,931	1.15	323,816	302,364	.93	+82	−19
Other	37,790	24,135	.64	125,175	92,351	.74	+231	+16
Total commercial sand	1,069,855	1,137,316	1.06	1,362,073	1,525,850	1.12	+27	+6
Gravel:								
Building	1,296,495	1,417,322	1.09	1,702,969	1,911,671	1.12	+31	+3
Road material	2,456,180	2,394,889	.98	4,264,404	4,687,747	1.10	+74	+12
Railroad ballast	211,705	196,145	.93	158,578	136,860	.86	−25	−8
Other	154,500	88,430	.57	589,871	517,486	.88	+282	+54
Total commercial gravel	4,118,880	4,096,786	.99	6,715,822	7,253,764	1.08	+63	+9
Total commercial sand and gravel	5,188,735	5,234,102	1.01	8,077,895	8,779,614	1.09	+56	+8
GOVERNMENT-AND-CONTRACTOR OPERATIONS								
Sand:								
Building	197,310	344,690	1.75	244,818	421,008	1.72	+24	−2
Road material				265,328	155,842	.59		
Total Government-and-contractor sand	197,310	344,690	1.75	510,146	576,850	1.13	+159	−35
Gravel:								
Building	516,675	807,655	1.56	293,947	451,750	1.54	−43	−1
Road material	2,860,358	2,243,185	.78	4,275,251	4,341,166	1.02	+49	+31
Total Government-and-contractor gravel	3,377,033	3,050,840	.90	4,569,198	4,792,916	1.05	+35	+17
Total Government-and-contractor sand and gravel	3,574,343	3,395,530	.95	5,079,344	5,369,766	1.06	+42	+12
ALL OPERATIONS								
Sand:								
Molding				1,183	6,980	5.90		
Building	1,051,895	1,253,940	1.19	1,156,717	1,545,163	1.34	+10	+13
Road material	177,480	203,931	1.15	589,144	458,206	.78	+232	−32
Other	37,790	24,135	.64	125,175	92,351	.74	+231	+16
Total sand	1,267,165	1,482,006	1.17	1,872,219	2,102,700	1.12	+48	−4
Gravel:								
Building	1,813,170	2,224,977	1.23	1,996,916	2,363,421	1.18	+10	−4
Road material	5,316,538	4,638,074	.87	8,539,655	9,028,913	1.06	+61	+22
Railroad ballast	211,705	196,145	.93	158,578	136,860	.86	−25	−8
Other	154,500	88,430	.57	589,871	517,486	.88	+282	+54
Total gravel	7,495,913	7,147,626	.95	11,285,020	12,046,680	1.07	+51	+13
Grand total	8,763,078	8,629,632	.98	13,157,239	14,149,380	1.08	+50	+10

The National Industrial Products Corp. (a Morrison-Knudsen subsidiary) began shipments of high-grade limestone from its quarry near Durkee, Baker County. The high-calcium limestone was shipped to

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consumers in the heavy chemical and metallurgical industries. A small shipment of chemical-grade limestone was made to a sugar refinery by the Chemical Lime Co. of Baker. Limestone for agricultural purposes was mined by the Greely Lime Co., Enterprise, Wallowa County, and Polk County Lime Co., Dallas, Polk County.

Monumental stone (Haines blue grey granite) was quarried near Haines, Baker County, by Northwestern Granite Co.

TABLE 15.—Stone sold or used by producers, 1953–54, by uses

Use	1953		1954	
	Short tons	Value	Short tons	Value
Building (dimension stone)	4,470	$40,735	3,921	$60,389
Concrete, road metal, and screenings	4,180,670	5,503,039	4,741,343	6,551,541
Riprap	90,830	77,831	193,326	184,763
Railroad ballast	255,530	234,604	60,280	66,070
Other [1]	407,580	445,430	873,483	1,755,032
Total	4,939,080	6,301,639	5,872,353	8,617,795

[1] Used at metallurgical and chemical plants, sugar refineries, and in the manufacture of paper and cement and for other unspecified purposes.

Talc (Soapstone).—Soapstone from a deposit in Skagit County, Wash., was ground by Stauffer Chemical Co. and Miller Products Co., both of Portland. The output, used in insecticides, was slightly below that in 1953.

Vermiculite.—Crude vermiculite from Libby, Mont., was exfoliated at the Portland plant of Vermiculite-Northwest, Inc. Output was used for insulation purposes.

MINERAL FUELS

Carbon Dioxide.—Production of dry ice from carbon dioxide recovered by the Gas-Ice Corp. at its Ashland, Jackson County, plant was about one-third less than the 1953 total. The gas was obtained from mineral water raised through drilled wells as deep as 300 feet. A similar plant was operated by the company near Klickitat, Wash.

Coal.—Intermittent operation was reported from three small coal mines: South Slough mine, Coos County; Madrona mine, Clackamas County; and Vernonia mine, Columbia County. Initial production from the Vernonia mine was recorded in May 1954. This mine was developed by water-level tunnels; the cleanest portion (upper 9 feet) of a 16-foot seam yielded the coal.

Petroleum and Natural Gas.—Interest in petroleum reached a new high in Oregon during the latter half of 1954. According to an article,[11] there was a sudden upsurge in oil-land leasing and expanded exploration by major oil companies. Over half of the million acres of Government land in the State was under lease; probably as much privately owned land was under lease also. Interested companies that have made some type of geological investigation or exploration include: Sinclair Oil & Gas Co., Richfield Oil Co., Standard Oil Co. of California, Humble Oil Co., The Texas Co., and El Paso Natural Gas Co.

[11] Haartz, Paul, The Oregonian: Northwest Roto Magazine, Apr. 3, 1955.

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Sediments that might contain oil occur in parts of Washington, Clatsop, Yamhill, Polk, Lincoln, Benton, Lane, Coos, Malheur, Crook, and Harney Counties. Two wells were driven during 1954 in Malheur County near Vale.

A well drilled in Douglas County reportedly encountered gas.

REVIEW BY COUNTIES

Baker.—Gold production was reported from 7 lode and 5 placer mines in the county. Michael S. LaCombe and T. D. Duncan reopened the Shamrock mine in Baker district and recovered some gold and silver by amalgamation during development. Placers, Inc. worked the Connor Creek placers in the Connor Creek district. The Columbia lode mine in the Cracker Creek district and the Old Crow lode mine in the Eagle Creek district were operated during part of 1954. In the Greenhorn district Greenhorn Mountain Development Co. began work at the Pyx lode mine after acquiring the property early in the year; C. R. Greer worked stream gravel by hydraulicking at the Mayflower mine; and W. A. Jefferson amalgamated gold ore from the Golden Eagle mine in the course of development. Gold was recovered from the Macy lode mine in the Sparta district. Powder River Dredging Co. discontinued production in September at its bucketline dredge on the Powder River in the Sumpter district after failure to locate additional gold-bearing gravels to work near the dredge site. The operation had been active nearly continuously since 1935, except for a 3-year shutdown during World War II, and had produced more gold than any placer or lode mine in the State throughout most of this period. In the Virtue district, Norman B. Gardner amalgamated gold ore from the Round Top claim. John H. Wright worked bench gravel at the China Bar drift mine in the Weatherby district and produced 22 ounces of gold.

Cement, stone, and sand and gravel were the principal nonmetallic commodities produced in the county. The Oregon Portland Cement Co. operated a cement plant and quarry at Lime. A small quantity of high-grade limestone mined at a deposit under development by the Chemical Lime Co. of Baker was shipped to a sugar refinery. Limestone from this deposit on Marble Creek ultimately will be shipped to the proposed company lime-burning plant at Wing. The National Industrial Products Corp. mined high-grade limestone at a quarry about 4 miles from Durkee. Crushing, conveying, and storage facilities were available for supplying the product to the chemical and metallurgical industries. Monumental granite was quarried by the Northwestern Granite Co. near Haines. Two companies produced sand and gravel.

Benton.—Sand and gravel and crushed gravel valued at $126,000 were produced by the Corvallis Sand & Gravel Co., Willamette Sand & Gravel Co., Tri-County Rock Co., and Beaton Sand & Gravel Co. Heavy clay products were manufactured by the Monroe Brick & Tile Co. and the Corvallis Brick & Tile Co.

Clackamas.—The output of cement, sand and gravel, stone, clay, and coal totaling over $5 million made Clackamas County an outstanding producer of mineral commodities in the State. The Oswego plant of the Oregon Portland Cement Co., active throughout the year,

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TABLE 16.—Value of mineral production in Oregon by counties, 1953–54

County	1953	1954	Minerals produced in 1954, in order of value
Baker	(1)	(1)	Cement, stone, gold, sand and gravel, silver.
Benton	$117,498	$209,176	Sand and gravel, stone, clays.
Clackamas	4,705,021	5,312,221	Cement, sand and gravel, stone, clays, coal.
Clatsop	15,735	124,464	Stone, sand and gravel.
Columbia	244,900	205,483	Sand and gravel, stone, coal, iron oxide pigment materials.
Coos	209,903	240,848	Stone, sand and gravel, coal.
Crook	(1)	124,448	Stone, mercury, sand and gravel.
Curry	65,088	(1)	Stone, chromite, sand and gravel.
Deschutes	1,047,494	907,049	Diatomite, pumice, sand and gravel.
Douglas	1,219,732	2,088,283	Sand and gravel, nickel, stone, mercury, chromite, gold, silver.
Gilliam	120,000	----------	
Grant	160,131	261,188	Chromite, stone, gold, silver, sand and gravel, copper, lead.
Harney	9,822	22,655	Sand and gravel, pumice, stone.
Hood River	37,500	44,700	Stone, sand and gravel.
Jackson	2,520,428	2,958,230	Cement, stone, sand and gravel, quartz, carbon dioxide, gold, chromite, mercury.
Jefferson	26,555	(1)	Stone.
Josephine	324,579	609,936	Chromite, sand and gravel, stone, gold, mercury, clays.
Klamath	49,770	166,303	Sand and gravel, stone, clays.
Lake	152,180	115,104	Sand and gravel, stone.
Lane	2,957,613	2,302,427	Do.
Lincoln	155,930	371,204	Stone, sand and gravel.
Linn	292,440	526,434	Sand and gravel, stone, clays.
Malheur	2,605	(1)	Clays, mercury.
Marion	169,140	540,083	Sand and gravel, stone, clays.
Morrow	93,335	(1)	Stone.
Multnomah	2,181,067	2,503,456	Sand and gravel, stone, clays.
Polk	173,912	465,782	Do.
Sherman	18,000	80,235	Sand and gravel, stone.
Tillamook	124,740	204,838	Sand and gravel, stone, clays.
Umatilla	282,250	550,737	Sand and gravel, stone.
Union	196,685	178,115	Sand and gravel, clays, gold.
Wallowa	195,945	189,031	Stone, sand and gravel.
Wasco	219,825	505,634	Sand and gravel, stone.
Washington	335,262	753,033	Sand and gravel, clays, stone.
Wheeler	----------	(1)	Gold, silver.
Yamhill	113,719	289,123	Sand and gravel, stone, clays.
Undistributed [2]	5,910,019	9,418,141	
Total	24,449,000	32,268,000	

[1] Included with "Undistributed" to avoid disclosure of individual company operations.
[2] Includes value of mineral production for sand and gravel, stone, gem stones, chromite, mercury, and tungsten production that cannot be assigned to specific counties.

used limestone shipped from Dallas, Polk County. Heavy clay products were made by the Molalla Brick & Tile Co. The value of sand and gravel and stone totaled a little more than $1 million. Sand and gravel was washed, crushed, and screened by 12 companies. Stone was crushed by the Weyerhauser Timber Co. for company-road construction and by the county highway department for road maintenance. Coal output from the Madrona mine by the Lowes-Mandrones Coal Co. was slightly below 1953.

Clatsop.—Road metal was produced by the Rock Creek Crushed Rock Co. and the Astoria Crushed Rock Co., both of Astoria. Sand and gravel was produced by the Mountain Construction Co. and the Brookfield Co.

Columbia.—Pit-run and crushed rock for construction and road repair was quarried near Rainier by the Goodat Crushed Rock Co. The county also produced stone for road repair. Sand and gravel was produced by the Parker Schram Co. and Watters Concrete Products Co. Initial coal output was recorded from the Vernonia mine.

Coos.—Pacific Northwest Alloys, Inc., began to construct a 150-ton-per-day-capacity plant to upgrade the World War II chromite stockpile at Coquille. A contract between the company and the

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Government provided for conversion of the reprocessed concentrate to ferrochrome at the company-leased (Government-owned) Mead plant near Spokane, Wash. The 55,000-ton stockpile, containing about 25 percent Cr_2O_3 resulted from operations in 1943 by Humphreys Gold Corp. and Krome Corp. on concentrations of black sands (containing chromite, magnetite, ilmenite, and other heavy minerals) formed by wave action along ancient beaches and offshore benches. Subsequent elevation of the coast and recession of the shoreline left the deposits several hundred feet above the shoreline and 1 mile or more inland. Developed and inferred reserves in 1943 totaled nearly 3 million tons of heavy sands containing 5 to 10 percent Cr_2O_3. The Humphreys Gold Corp. and Krome Corp. operations in 1943 processed approximately 500,000 tons of sand and produced 87,840 short tons of concentrates averaging about 25 percent Cr_2O_3, which were shipped to a secondary processing plant built by the Defense Plant Corp. and operated for the Government by Southwestern Engineering Co. These operations were halted in December 1943 because of the availability of higher grade foreign chromite, despite wartime transportation problems. The first mining of these chromite-bearing beach deposits since cessation of the operations was in prospect in 1954 when the Mineral Sands Co. of Lansing Mich., announced plans for constructing a plant for concentrating chromite from the sands by physical and newly developed chemical methods. Open-pit mining of the sands on a 4,000-acre site that included the old Pioneer mine in the Seven Devils district near Coquille was planned.

Hillstrom Rock Quarry, Inc., produced traprock from its Kentucky Slough quarry near Coos Bay. Riprap was quarried by the Bandon Rock Co. The county highway department quarried traprock for use as riprap and road metal. Rogers & Kuni and Elmer Benham produced sand and gravel. Locomotive sand for the Southern Pacific Railroad was prepared by Herman A. Fierke from a deposit near Hauser. The South Slough coal mine produced about 22 percent less coal than in 1953.

Crook.—Rapidly rising mercury prices stimulated exploratory and development work at properties in the county. Frank Reid and associates, operating under the name of Canyon Creek Mining Co., investigated the Mother Lode property by bulldozer trenching and produced a number of flasks of mercury during the development. The county's largest quicksilver producer was the Erspamer and Benson Amity (Ochoco) mine; the property was leased in November by Owen Pigmon (New Amity Mining Co.) and was called the New Amity mine. Output of a number of flasks also was reported by the latter company. Other small producers were the Platner mine, the Towner Motor Co. Lost Cinnabar No. 1 mine, and the Winter Creek Mining Co. Winter Creek (Blue Ridge and No. 1) mine. Exploratory work under a DMEA contract was carried on at the John McManmon Pinkey No. 1 and 2 claims, and D. E. Glover reported exploratory tunneling at the Barnes Butte mine.

The Cinder Hill Rock Co., Prineville, quarried and crushed traprock and marketed pit-run and graded volcanic cinders from deposits near Redmond, Prineville, and Madras. Sand and gravel for build-

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ing purposes and road construction was produced by Prineville Sand & Gravel Co. and Duffy Knorr.

Curry.—Chromite ore was produced by eight operators and shipped to the Government stockpile at Grants Pass. At the J. R. Holman Wonder & Daily Dozen properties, 1,500 tons of ore was mined from which 276 short wet tons of 48-percent Cr_2O_3 concentrate was recovered. Fred Gardner & Sons produced nearly 90 tons of lump ore, fines, and some concentrate from the Fourth of July mine. Howard Beasley leased the Sourdough mine, previously operated by Bristol, Baker & Leonard, in July; lump ore and concentrate were produced by both operators. The largest output in the county was from the B. A. and R. E. McCaleb chrome mine; ore was mined under contract by Ralph and Katie Kaiser and upgraded in the McCaleb mill before shipment to Grants Pass. Other chromite producers were Ernest A. Foster (Pearsoll Peak mine and mill), W. A. Scofield (Little Siberia mine), and Six-Mile Chrome Co. (Jean Pressler mill and Roy Jackson mine). Ores from other Oregon counties and from California also were treated at the Six-Mile Chrome Co. mill on a custom basis.

Peter Kiewit & Sons produced sandstone at a portable plant. City Sand & Gravel Co., Gold Beach, and Edington Sand & Gravel, Langlois, had a small sand and gravel output.

Deschutes.—Great Lakes Carbon Corp. continued to operate its diatomite quarry and processing plant at Terrebonne. This operation again was the only diatomite producer in Oregon and the leading mineral-industry activity in the county. Pumice for lightweight aggregate was produced by the Central Oregon Pumice Co. and Lloyd A. Williamson (Williamson Cascade Pumice quarry), both of Bend, and Deschutes Concrete Products Co., Tumalo. A small quantity of prepared pumice was used in manufacturing acoustic plaster and as a sweeping compound. Volcanic cinder for road ballast and asphaltic aggregate was produced by Cinder Hill Quarry of Redmond. Sand and gravel was produced by the Bend Sand & Gravel Co.

Douglas.—Three placer-gold operations were active. The largest was in Riddle district, where Leo D. Baker hydraulicked the Victory property during the winter, when water was available, and washed 60,000 cubic yards of gravel. Auriferous gravels were worked also at two locations in Umpqua (Wolf Creek) district. A small output was recorded by five chromite producers in the county. Concentrate was produced at the Harry and Lester Shippen Triple L mill from ore from the Triple L mine, the Stanley Davis mine, and the Fourth of July mine (Curry County). The Fitzpatrick Bros. milled ore from their Linda Marie mine and purchased and milled ore from the Triple L mine. Dorothy Kartes produced lump ore from the Nickel Mountain mine before leasing it to the Lucky Nine Chrome Corp. in July; concentrate was produced from ore from the mine by the latter operator. The Bonanza Oil & Mine Corp. Bonanza mine near Sutherlin continued as the only large mercury producer in the State. Prices in the early part of the year, coupled with the low grade of the ore and high operating costs, forced closure of the mine on February 15; however, the per flask value of mercury rose rapidly in succeeding months, and the mine was reopened June 1. Restoration of the Gould

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rotary furnace to service and pumping out of the lower levels of the mine, which had been allowed to flood during the shutdown, were accomplished shortly afterward. Bernard Young and Steve Cooper reported retimbering and tunnel-driving work and revamping of the retort and condensing system at the Maud S. mine near Tiller. Hanna Coal & Ore Corp. reported production of 124,547 short tons of nickel ore containing approximately 1.6 percent nickel at the new Hanna nickel development near Riddle. Reports indicated that the smelting subsidiary, Hanna Nickel Smelting Co., produced about 300,000 pounds of nickel contained in ferronickel. The plant also produced ferrosilicon for use in the ferronickel production process. Operations at the plant were begun the first part of June, electric-power requirements being supplied under a 20-year contract with the BPA. Plant facilities included four 900-ton-capacity orebins, a 120- by 400-foot smelter building, and auxiliary buildings. According to a description of the projected operations at the site,[12] ore was to be transferred from the open-pit mine via a 2,400-foot, 2-ton bucket-cable tramway having an estimated 3,000-ton-per-day capacity. At the plant site the crushed and dried ore would be fed into 250-foot rotating calciners and transferred into bins above the furnaces.

The output of sand and gravel and stone, valued at $940,000 and $358,000, respectively, ranked Douglas County third in production of these commodities. Principal sand and gravel producers were Roseburg Sand & Gravel Co., Roseburg; Umpqua River Navigation Co., Reedsport; and Whipple Logging Co., Drain.

Grant.—In the Canyon district Henry M. Brown operated the Black Butte mine during part of 1954 and recovered 22 ounces of gold and 3 ounces of silver from 60 tons of ore amalgamated. In the Granite district, the Buffalo mine, Oregon's principal gold-lode mine still in operation, was worked throughout the year by Boaz Mining Co. of Seattle. Production totaled 2,004 tons of ore from which 167 tons of gold-silver concentrates containing 1,002 ounces of gold, 12,814 ounces of silver, and a small tonnage of copper and lead was recovered in the Buffalo flotation mill. Ray E. Summers shipped some copper ore during development at the Standard mine in the Quartzburg district. The value of chromite produced in the county increased substantially over 1953. Concentrate was produced and shipped to the Grants Pass Purchase Depot by John Day Mining Co. (Dry Camp mine), Burt Hayes (Haggard & New mine), and Glenn Findlay (Kingsley mine). The Burt Hayes operation was the second largest in the State, in terms of value of materials shipped. No mercury was reported produced during the year from the Roba and Westfall Deer Creek property; however, exploratory work was done under a $20,140 DMEA contract.

A small quantity of sand and gravel was produced by the John Day Gravel Co. Crushed stone for road construction was prepared by contractors for the Bureau of Public Roads.

Harney.—Pit run and washed sand and gravel were marketed by the Burns Sand & Gravel Co. Pumice for lightweight aggregate, road metal, and railroad ballast was mined by the Harney Concrete Tile Co., Burns. A small quantity of crushed stone was used for roadwork.

[12] Engineering and Mining Journal, vol. 154, No. 12, December 1953, pp. 153–154.

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Hood River.—Crushed stone for road building was obtained from the Trout Creek quarry by the county highway department. Ledbetter & Co., Hood River, prepared sand and gravel for building purposes.

Jackson.—Most of the activity at the small gold mines in the county was centered in the Upper Applegate district. Collings Bros. worked the Rising Sun pocket mine for about 3 months and recovered 34 ounces of gold and 12 ounces of silver. W. L. Lorsung produced a small quantity of gold at the Mountain Lily lode mine during assessment and prospecting. The Winkler pocket mine was operated during part of 1954 by W. R. Winkler. L. F. Lorsung developed the Steamboat lode mine under a 6-month lease and discontinued mining November 1. A. E. Collings operated the Blow Snake pocket mine and produced 35 ounces of gold and 5 ounces of silver. Christean Bros. worked a dragline and floating washing plant during part of the year and recovered 11 ounces of gold from 3,000 cubic yards of gravel washed. Paul Pearce produced gold and silver by hydraulicking at the Sterling placers. Robert B. Hunnicutt developed the Bonus No. 1 and 2 placer claims. In the Gold Hill district Ernest F. Kell produced 2 ounces of gold during development at the Smuggler lode mine. Three small placer operations, including a suction dredge, were active for brief periods. Small quantities of chromite ore were shipped by E. O. Crouch (Pleasant Creek No. 1 mine), E. K. McTimmonds (Red Mountain mine), and L. M. Wilson (Basey mine). J. A. and J. H. Holtzclaw and S. A. Edwards, operating at the War Eagle property, reported production of a small quantity of quicksilver.

The value of cement, stone, sand and gravel, silica (quartz), and carbon dioxide output totaled $2,944,000, compared with $2,513,000 for 1953. This increase placed the county second in order of nonmetallic commodity importance. The Ideal Cement Co., Pacific Division, continued cement production at its Gold Hill plant. The county ranked first in the State in value of stone output ($502,000). Traprock for use in road construction was quarried by the Newport Construction Co. of Medford. M. C. Lininger & Sons, also of Medford, operated a portable plant to prepare traprock for the Forest Service near Prospect and for the Oregon State Highway Commission on the Siskiyou summit. The county highway department also produced road metal. Sand and gravel for building and paving purposes was prepared by M. C. Lininger & Sons, Medford Concrete Construction Co., and Bateman & Sons, all of Medford. Production of silica (quartz) was increased for the third consecutive year from the Rogue River quarry by the Bristol Silica Co. Carbon dioxide from mineral waters was processed to dry ice by the Gas-Ice Corp. of Ashland.

Jefferson.—Idle since closed by a fire November 22, 1944, the Horse Heaven mercury mine east of Ashwood was to be reopened in 1955 by Cordero Mining Co., according to plans revealed in the latter part of 1954. News reports indicated that the company planned to install a 25-ton rotary furnace to treat ore mined before the 1944 closure and low-grade ore bodies not mined out previously. The Horse Heaven mine, discovered in 1933 by A. J. Champion, first was worked by the Crystal Mining Syndicate in 1934 and 1935. The

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property was transferred to Horse Heaven Mines, Inc., a subsidiary of Sun Oil Co., in 1936 and produced continuously through 1944. Small production was reported in 1945 as a result of cleanup activity at the furnace site. The mine was the largest producer in Oregon and the second largest in the United States in 1938 and ranked second and fifth, respectively, in 1939.

Rough and dressed rhyolitic dimension stone valued at $32,500 was marketed by the Pacific States Cut Stone Co. of Madras. In the same area, another producer, the Colorite Stone Co., sold a polished, cemented aggregate under the trade name "Colorite." It was used for mantels, table tops, and building facings.

Josephine.—Development at several small gold mines yielded some gold and silver in 1954. In the Galice district Harry C. Commers and C. W. Robertson developed the Howland lode mine and work was done at the Rogueside, Last Chance, and Jump-Off-Joe placers by Frank Crawford, Quentin Stone, and Frank Heath, respectively. Northwest Mining Development Co. operated its property in the Greenback district. Production of chromite in the county decreased 12 percent from 1953; shipments to the Grants Pass Depot were made by 19 operators, compared with 21 the previous year. As in 1953, the Waldo Milling Co. was the largest producer in the State in terms of value of material shipped; the company output of concentrate was derived from ores taken from the Golconda, Bolan Lake, and Esterly mines. The second largest production in the county was that of Wm. S. Robertson at the Oregon Chrome mine in the Illinois River district. Hand-sorted lump ore and fines were shipped to the stockpile, and reject ore was trucked to the J. G. Gallaher mill in Grants Pass for upgrading and sale to the purchase depot. Material from the Robertson Cyclone Gap mine in California also was treated at the Gallaher mill. D. W. Bowers shipped 167 tons of concentrate averaging 51 percent Cr_2O_3 from the Sordy property, and E. K. McTimmonds produced 110 tons of lump ore, fines, and concentrate from the Lucky Star mine. Other operators in the county during the year were Edward Buckley (Paradise), A. O. Craig (Saturday Anne), E. A. Foster and Roy Hillis (Hammer), Grisson and Inman (Deep Gorge), King & Hansen Mining Co. (Chrome King No. 1), Donald Hassler (Dark Star), Fred Langley (Langley), M. J. McShane (Black Beauty), Tulare Bros. (Chrome Ridge), R. W. Radcliffe (Lucky L & R), Olsen and Scofield (Mockingbird), Carl Stevens (Hammer), and A. Strickland and G. E. Smith (Mockingbird).

Limestone from the Marble Mountain quarry near Wilderville was shipped to the Ideal Cement Co., Pacific Division, plant at Gold Hill, Jackson County. Sand and gravel for use as building and paving materials was prepared by M & M Sand & Gravel Co., Rogue River Sand & Gravel Co., and Mark Axtell, all of Grants Pass. Crushed stone was used for roadwork.

Klamath.—Sand and gravel for various uses was produced by the Farmers Sand & Gravel Co., O. A. McCord, W. D. Miller Construction Co., Shasta Sand Co., all of Klamath Falls, and the Great Northern Railway Co. at Dehlinger. Traprock was quarried by the W. D. Miller Construction Co. near Klamath Falls. Clay from the Klamath pit was used by the Klamath Falls Brick & Tile Co. to

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manufacture structural clay products. The company also imported some clay from Lincoln, Calif.

Lake.—Exploration activity was reported at the Glass Buttes mercury property in the northeastern corner of the county by Kennametals, Inc.

Paving sand and gravel was produced by the L. A. Decker Sand & Gravel Co. at Lakeview. A small quantity of limestone was prepared for road construction.

Lane.—National Metallurgical Corp., a subsidiary of Apex Smelting Co. and American Smelting & Refining Co., began initial operations at its new plant near Springfield in January. Silicon metal and aluminum-silicon alloy were produced on a limited scale during experimental operations, which were continued throughout the year. About 30 men were employed.

Lane, the principal sand- and gravel-producing county in the State, reported a total output of 2.2 million tons valued at $2.1 million. Fifteen companies supplied sand and gravel for paving and construction purposes. Crushed rock and riprap used for flood control were produced by L. P. Stubblefield from eight quarries in the Eugene area. The Mapleton Rock Production Co. quarried limestone for road ballast. Traprock for riprap and road construction was produced by the Eugene Sand & Gravel Co.; T. M. Nielson, Deadwood; and the Bohemia Lumber Co., Culp Creek. The Southern Pacific Railroad Co. quarried railroad ballast near New Era.

Lincoln.—The value of stone output in the county ranked fourth in the State ($331,000). Basalt was quarried and crushed by Don Morris (Yaquina Head quarry), Newport; Calkins Crushing Co. (Kernville quarry), Oceanlake; L. R. Kauffman & Son, Waldport; and E. C. Hall Co. The output was used for road construction, particularly for logging roads in the Waldport area. The county highway department quarried rock for road ballast and riprap and produced a small quantity of river gravel. Paving gravel was produced by Don H. Morris, Oceanlake.

Linn.—Zirconium and hafnium sponge and ingots were produced at the Bureau of Mines Northwest Electrodevelopment Experiment Station at Albany for the Atomic Energy Commission throughout the year.

Sand and gravel valued at $462,000 was produced by 12 companies. Output was used mainly for paving and construction. Clay mined by the Albany Brick & Tile Co. was made into heavy clay products. The county highway department crushed stone for road repairs.

Malheur.—Don L. Toland reported production of a few flasks of mercury as a result of cleanup operations around the old plant site at the Opalite No. 1 mine.

Oregon Clay Products Co., Vale, manufactured all types of building brick from clay obtained at the company-owned Vale pit. Description of a diatomite deposit controlled by Malheur Wunder Earth, Inc., Vale, appeared in a Geological Survey bulletin.[13] Development was started on an open-pit gypsum deposit by Cimota Enterprises, Inc. The Northwest Perlite Co., Portland, diamond-drilled a deposit of perlite near Sheaville.

[13] Moore, B. N., Nonmetallic Mineral Resources of Eastern Oregon: Geol. Survey Bull. 875, 1954, 180 pp.

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Marion.—Research on the production of alumina (the basic raw material consumed by aluminum-reduction plants) from high-alumina lateritic deposits found near Salem was conducted by the Harvey Machine Co. at Salem. The operations were carried on at the plant built by the Government during World War II for work on high-alumina clays and purchased by Harvey in 1953.

Exploratory drilling of the aluminum-bearing laterites in the Salem Hills area was conducted by the State of Oregon Department of Geology and Mineral Industries. A total of 15 auger holes was drilled and sampled during the year. Results of this work were published.[14]

Marion County ranked fifth in value of sand and gravel output ($528,000). Seven companies furnished paving and construction sand and gravel. Sawed blocks of volcanic tuff (Fern Ridge tuff) were produced by the Oregon Tuff Stone Co. at its quarry 6 miles southeast of Sublimity. Block and brick sizes are used in construction; larger sizes have been used for fireplaces, hearths, and mantels. The Needy Brick & Tile Co. and Hubbard Brick & Tile Co., both of Hubbard, manufactured heavy clay products from clay obtained from pits in Clackamas County. The Donald Brick & Tile Co. produced similar products from locally mined clay.

Morrow.—The county highway department quarried and crushed stone for use in road construction.

Multnomah.—Multnomah County ranked fourth in total value of nonmetallic mineral production ($2.5 million) and first in sand and gravel output ($2.4 million). Eleven sand and gravel companies contributed to the total of 2,142,000 tons. Rough dimension stone was mined by Joe Marston at the Rocky Butte quarry, and the county produced crushed stone for roadwork. The Columbia Brick Works and Sylvan Brick Co., both of Portland, manufactured heavy clay products. Pacific Stoneware Co., Portland, made flowerpots and stone ware from clays imported from Yamhill County. Shale mined near Buxton, Washington County, was expanded for use in lightweight aggregate by Smithwick Concrete Products Co. of Portland. Improvements at the plant included installation of a new drying room capable of handling 2,000 8- by 8- by 16-inch concrete masonry units or 4,000 partition units simultaneously. Perlite from Pioche, Nev., was expanded at the North Portland plant of Supreme Perlite Co.

Chemical and metallurgical plants were active in the county, using local and imported mineral raw materials. Alumina shipped into the State was consumed in manufacturing aluminum metal at the Reynolds Metals Co. reduction plant at Troutdale. Pacific Carbide & Alloys Corp. and Union Carbide & Carbon Corp. operated in Portland the only two calcium carbide plants on the Pacific coast. Electro Metallurgical Co. produced ferrosilicon and silicon, and caustic soda and chlorine were produced by Pennsylvania Salt Manufacturing Co. Insecticides were produced by Stauffer Chemical Co. and Miller Products Co. and electric furnaces and a rolling mill were operated by Oregon Steel Mills.

Polk.—Sand and gravel for paving and construction was produced by Burch Gravel Co., Buell; Dale Grossman and Valley Concrete Co., Independence; and W. C. Hill, Rickreall. The Burch Gravel Co. sold

[14] Corcoran, R. E., Investigation of Salem Hills, Oregon, Bauxite Deposits: Oregon Dept. of Geol. and Mineral Ind., The Ore-Bin, vol. 16, No. 9, September, 1954.

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traprock from its quarry near Buell for road construction and railroad ballast. The county also quarried rock for road building. Molding sand was prepared by the La Grand Industrial Supply Co., Portland, from its open pit near Monmouth. Agricultural limestone was mined by the Polk County Lime Co. from a quarry near Dallas. The Lime Products Co. of Salem did not operate its limestone quarry. Building brick and drain tile were manufactured from locally mined clay by the Monmouth Brick & Tile Co.

Sherman.—Crushed stone and washed gravel were prepared by the county highway department for road material.

Tillamook.—The Dolan Construction Co. produced building sand and paving gravel. Gravel and crushed stone were prepared by the county highway department for road maintenance. Drain tile was manufactured by the Tillamook clay works.

Umatilla.—Special sand, used mainly as engine sand, was produced by O. O. Felthouse, Hermiston. The Columbia Sand & Gravel Co., Umatilla, marketed a small quantity of filter sand, as well as building sand and gravel. Four other companies reported output of building sand and gravel and paving gravel. Railroad ballast was quarried by the Union Pacific Railroad, and base rock was mined by the county highway department.

Union.—Rainbow Mines of Union County, a partnership, operated two hydraulic giants on the Rainbow placers in Camp Carson district and recovered a small quantity of gold during development.

Sand and gravel for building and paving purposes was produced by the La Grande Concrete Pipe Co., Island City. Building brick was made by the La Grande Brick Co., La Grande, from locally mined clay.

Wallowa.—Limestone for agricultural purposes and for making calcium carbide was mined at the Black Marble quarry near Enterprise by the Greely Lime Co., a subsidiary of Pacific Carbide & Alloys Co., Portland. Joseph Concrete Products, Joseph, made concrete block and drain tile and operated a gravel pit and preparation plant. Two other companies produced sand and gravel.

Wasco.—Much of the stone and sand and gravel produced in the county (total value sand and gravel—$315,000) was used by the U. S. Army Corps of Engineers at The Dalles Dam construction site. Plaster sand and building and paving sand and gravel were produced by The Dalles Concrete Products Co. Gravel for highway construction was supplied by the E. C. Hall Co. The output of stone in the county was valued at $191,000. Traprock for road construction was quarried by E. C. Hall Co. and C. M. Thomas. Tuff stone was mined by D. A. Temple at the Rainbow Rock quarry near Pine Grove. This operation was in the development stage. The Union Pacific Railroad Co. quarried traprock for ballast.

Washington.—Paving gravel was recovered by the Tigard Sand & Gravel Co., Tigard; Gales Creek Sand & Gravel Co., Gales Creek; and L. H. Cobb, Beaverton. Northwest Aggregate, Inc. (Empire Building Materials Co.), Portland, continued to expand shale for use as lightweight aggregate at its plant near Banks. Shale from a deposit near Buxton was shipped to Smithwick Concrete Products Co., Portland, for expanding into lightweight aggregate (Haydite). Brick was made by the O. K. Brickyard, Sherwood, and the Scholls Tile

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Co. of Hillsboro manufactured drain tile. Rock was quarried and crushed for roadwork by the county.

Wheeler.—Two gold mines in Spanish Gulch district were active. A. C. New worked the Rosa D. pocket mine and recovered some gold and silver. E. O. Waterman operated a hydraulic giant and bulldozer on the Waterman placer claims.

Yamhill.—Sand and gravel for construction and road building was processed by the Grand Island Sand & Gravel Co. and the Willamette River Gravel Co., both of Dayton; and by the McKibben Sand & Gravel Co., Sheridan. Basalt for road construction and riprap was quarried by the Crabtree Rock Co., Newberg; Amity Sand & Gravel Co., Amity; and O. C. Yokom, McMinnville. Common brick and drain tile were made by the McMinnville Brick & Tile Co. and face and common brick were manufactured by Willamina Clay Products Co.

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The Mineral Industry of Pennsylvania

This chapter has been prepared under a cooperative agreement for the collection of mineral data except mineral fuels between the Bureau of Mines, United States Department of the Interior, and the Pennsylvania Topographic and Geologic Survey.

By Robert D. Thomson[1]

PENNSYLVANIA mineral production totaled $926 million in 1954, a 17-percent decrease in value compared with 1953. The State continued to be an important source of mineral commodities in the United States, producing a wide variety of minerals. In 1954, 75 percent of the value of the State mineral output was attributable to

TABLE 1.—Mineral production in Pennsylvania, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement—376-pound barrels	42,093,765	$114,002,846	43,068,234	$117,912,299
Clays	[2] 3,575,287	[2] 9,987,928	3,524,398	10,243,485
Coal:				
Anthracite	30,949,152	299,139,687	29,083,477	247,870,023
Bituminous	93,330,871	516,490,411	72,010,101	378,658,531
Cobalt (content of ore)—pounds	564,450	[3]	517,124	[3]
Copper (recoverable content of ores, etc.)	3,027	1,737,498	[3]	[3]
Gold (recoverable content of ores, etc.)—troy ounces	1,134	39,690	1,317	46,095
Iron ore (usable)—long tons, gross weight	1,020,826	[3]	708,109	[3]
Lime (open-market)	1,335,300	16,010,114	1,081,583	13,206,310
Natural gas—million cubic feet	105,558	30,717,000	145,934	43,634,000
Natural-gas liquids:				
Natural gasoline—thousand gallons	[3]	[3]	4,830	320,000
LP-gases—do	1,008	90,000	1,008	89,000
Peat	8,232	47,516	15,621	141,352
Petroleum (crude)—thousand 42-gallon barrels	10,649	45,680,000	[4] 9,107	[4] 31,150,000
Sand and gravel	14,715,383	20,692,391	14,218,444	20,595,990
Sericite schist	2,463	[4] 4,926	1,898	8,541
Silver (recoverable content of ores, etc.)—troy ounces	6,972	6,310	8,415	7,616
Slate	202,386	4,419,612	194,205	4,419,439
Stone	[5] 26,192,607	[5] 48,094,029	40,521,756	61,193,419
Undistributed: Graphite (crystalline, 1953), mica, pyrites, ground sand and sandstone (1953), stone (dimension basalt, 1953), recovered elemental sulfur, tripoli, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3). Excludes value of clays used for cement in 1953		14,461,911		12,548,574
Total Pennsylvania		[2] 1,121,622,000		[7] 925,545,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Revised figure.
[3] Included with "Undistributed" to avoid disclosure of individual company operations.
[4] Final figure. Supersedes preliminary figure given in commodity chapter.
[5] Estimate.
[6] Excludes limestone for cement and lime, and other stone, value for which is included with "Undistributed."
[7] The total has been adjusted to eliminate duplication in the value of clays and stone.

[1] Commodity-industry analyst, Region V Bureau of Mines, Pittsburgh, Pa.

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fuels, 24 percent to nonmetals, and 1 percent to metals. Coal, cement, stone, natural gas, and petroleum, in order of decreasing value, were the most important economically.

Production of one or more mineral commodities was reported in every county in 1954. The major producing counties for metals and nonmetals, in order of decreasing value, were Northampton, Lehigh, Lebanon, Lawrence, and Allegheny. Leading bituminous-coal-producing counties were Allegheny, Cambria, Fayette, Greene, and Washington. Luzerne and Schuylkill Counties were prominent producers of anthracite.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Both anthracite and bituminous coal were mined in Pennsylvania in 1954. The Pennsylvania anthracite fields underlie a surface area of approximately 484 square miles and are divided into 4 fields—the Northern, Eastern Middle, Western Middle, and Southern. The Northern field, about 55 miles long, falls largely in Lackawanna and Luzerne Counties and in parts of Susquehanna and Wayne Counties.

The Eastern Middle field, which centers around Hazelton, lies principally in southern Luzerne County and parts of northern Schuylkill and west Carbon Counties. The Western Middle field lies between the Susquehanna River and the headwaters of the Little Schuylkill River in northwest Schuylkill County, south Columbia County, and east central Northumberland County. The Southern field, the largest of the four, extends over approximately 181 square miles between Jim Thorpe on the Lehigh River to Dauphin on the Susquehanna River, extending over parts of southern Carbon, the middle portion of Schuylkill, and parts of northern Dauphin and Lebanon Counties.

The bituminous-coal fields underlie most of the western part of the State from a line drawn northward from Fulton County to Tioga County, that is, the counties west of Fulton, Huntingdon, Centre, Clinton, Lycoming, and Bradford Counties.

Production in 1954 showed a 17-percent drop in total value from 1953 for anthracite and 27 percent for bituminous coal. The percentage of anthracite produced at underground operations remained at 58 percent. Production at strip mines and recovery of culm-bank coal declined slightly from the 28 and 13 percent, respectively, reported for 1953. The remaining production of anthracite came from dredging rivers in Berks, Lancaster, Lebanon, Northampton, and Snyder Counties. Luzerne County led in anthracite production with 10,368,743 tons valued at $97,219,682, followed by Schuylkill County with 8,733,691 tons valued at $69,090,017. About one-fourth of the 1954 bituminous production came from stripping operations. Wash-

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ington County led in total output of bituminous coal, while the largest tonnage from strip mines came from Clearfield County.

Peat.—Output of peat in 1954 in Pennsylvania increased 90 percent in tonnage and about 200 percent in value compared with 1953. Output came from Luzerne (ranking first in production), Lawrence, Erie, and Mercer Counties.

Petroleum and Natural Gas.—Production of natural gas in Pennsylvania in 1954 increased 38 percent in volume and 42 percent in value compared with 1953, whereas production of petroleum decreased 14 percent in quantity and 32 percent in value. The average daily oil production in 1954 was 24,995 barrels, compared with 29,115 barrels in 1953, a decline of 14 percent.[2]

The drop in petroleum production was due in large measure to a change in the price structure. At the beginning of 1954 the price received in the Bradford district was cut to $3.75 per barrel, in the Middle district to $3.70, and in the Southwest district to $3.31. On May 20 the prices were reduced further to $3.26, $3.20, and $2.81, respectively. On December 1, they were raised to $3.35, $3.25, and $2.93, respectively. The lower prices resulted from a loss of foreign markets and a decline in domestic demand for the heavier lubricating-oil fractions obtained from Pennsylvania crude oil. No gas or oil discoveries of major significance were made in Pennsylvania during 1954. Major drilling activity was confined largely to the Benezette-Driftwood Oriskany-sand gas field in northcentral Pennsylvania. In all, 1,008 shallow-sand wells were completed in 1954, compared with 1,706 in 1953. Of these, 204 were gas wells, 41 were oil wells, 129 were dry holes, 5 were for gas storage, and 629 were drilled in connection with secondary-recovery oil operations. The 204 new gas wells had a total initial open-flow capacity of 15,504,000 cubic feet per day as compared with the total initial open-flow capacity of 37,222,000 cubic feet of the 220 gas wells completed in 1953. The 41 new oil wells had a total initial production of 106 barrels per day, compared with 152 barrels from the 40 oil wells completed in 1953.

One new shallow-sand gas pool of minor importance was developed in Delaware Township, Mercer County, in 1954. The greatest activity in the shallow-sand gas belt of western Pennsylvania occurred in Jefferson County, where 51 gas wells were completed at an average total depth of 2,877 feet. The greatest number of oil wells completed was in Butler County, where 18 wells had a total average depth of 1,938 feet. In all, the 374 wells completed in 1954 had an average total depth of 2,527 feet.

In addition to the production of natural gas, natural-gas liquids were produced as byproducts, as shown in table 1.

METALS

Iron Ore.—The Bethlehem Steel Co. Cornwall mines in Lebanon County were Pennsylvania's only metal-ore producers in 1954. Production consisted of iron ore containing pyrite, in association with minerals containing copper, gold, silver, and cobalt. Usable iron ore produced at Lebanon concentrator totaled 708,100 long tons, a 31-

[2] Fettke, C. R., and Lytle, W. S., Developments in Pennsylvania in 1954: Bull. Am. Assoc. Petrol. Geol., vol. 39, No. 6, June 1955, pp. 811–821.

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percent decrease compared with 1953. Byproduct ore obtained by treating the copper-yielding concentrate totaled 1,317 ounces of gold valued at $46,100, 8,400 ounces of silver valued at $7,600, and a quantity of copper. Pyrite and cobalt also were obtained by treating the pyrite concentrate.

Bethlehem Steel Co. continued work on the Grace iron mine, Morgantown, Berks County, in 1954. Work on the 2 Morgantown shafts, 1 at a depth of 1,600 feet and the other 1,200 feet, began in 1951 and was expected to be completed in 2 years. However, heavy water inflows and other adverse conditions have lengthened the construction period another 2 years. Full-scale production is scheduled for 1960, and it is estimated that approximately 12,000 tons of iron ore will be produced daily when full production is reached.

Pig Iron and Ferrous Scrap.—Production of pig iron in Pennsylvania in 1954 was 14.7 million net tons, 29 percent less than in 1953 and 13 percent less than in 1952. A total of 27 million net tons of iron and manganiferous iron ore, sinter, and miscellaneous metalliferous materials was used in producing pig iron. Of the iron ore consumed, 85 percent came from domestic mines, and the remainder was imported. The metalliferous materials consumption per ton of pig iron produced in 1954 totaled 1,832 tons, a decrease compared with 1953. The annual capacity of blast furnaces as of January 1, 1955, in Pennsylvania totaled 23.6 million net tons for 78 furnaces, an increase of 2 percent above the previous year. Distribution and capacity of the blast furnaces are shown in table 3.

During 1954 pig iron and ferrous scrap consumption in Pennsylvania decreased 29 and 32 percent, respectively, compared with 1953. The consumption, by type of furnace, is shown in table 4. The annual capacity of open-hearth, bessemer, electric, and crucible furnaces in Pennsylvania, as of January 1, 1955, is given in table 5.

Zinc.—Development at the New Jersey Zinc Co. Friedensville property continued. Pumps mounted in boreholes were effectively lowering the water table in December 1954. The first housing project at Friedensville was completed in expectation that a working force of

TABLE 2.—Iron ore and other metallic materials consumed and pig iron produced, 1952–54, in net tons

	1952	1953	1954
Metalliferous materials consumed:			
Iron and manganiferous iron ores:			
Domestic	21,087,233	25,796,941	14,662,762
Foreign	719,858	833,015	2,565,932
Sinter	7,382,109	9,022,055	7,223,233
Miscellaneous	2,893,234	3,636,834	2,505,717
Total	32,082,434	39,288,845	26,957,644
Pig iron produced	16,890,004	20,718,641	14,717,549
Materials consumed per ton of pig iron:			
Ores	1.291	1.285	1.171
Sinter	.437	.435	.491
Miscellaneous	.171	.176	.170
Total	1.899	1.896	1.832

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400 will be needed for the mine and services. The mine output was estimated at 2,500 tons of ore per day. The mine is opened through a vertical shaft.

TABLE 3.—Annual capacity of blast furnaces, January 1, 1955, in net tons [1]

[American Iron and Steel Institute]

District	Location	Operator	Number of stacks	Annual capacity
Pittsburgh-Youngstown	Aliquippa	Jones & Laughlin Steel Corp	5	1,800,000
	Braddock	United States Steel Corp. (central operations).	7	2,730,200
	Clairton	do	3	639,800
	Donora	American Steel & Wire Division	2	450,000
	Duquesne	United States Steel Corp. (central operations).	6	1,313,100
	Farrell	Sharon Steel Corp	2	561,000
	McKeesport	National Tube Division	4	1,280,300
	Midland	Crucible Steel Co. of America	3	895,000
	Monessen	Pittsburgh Steel Co	3	960,000
	Neville Island	Pittsburgh Coke & Chemical Co	2	654,000
	Pittsburgh	Jones & Laughlin Steel Corp	6	1,927,000
	Rankin	United States Steel Corp. (central operations).	6	2,236,800
	Sharpsville	Shenango Furnace Co	2	445,450
Eastern	Bethlehem	Bethlehem Steel Co	7	2,708,000
	Bridsboro	Colorado Fuel & Iron Corp	1	151,200
	Chester	Chester Blast Furnace, Inc	1	200,000
	Erie	Interlake Iron Corp	1	271,000
	Fairless Hills	United States Steel Corp. (central operations).	2	1,134,000
	Johnstown	Bethlehem Steel Co	7	1,708,000
	Palmerton	New Jersey Zinc Co	2	112,000
	Sheridan	Lavino & Co., E. J	1	56,000
	Steelton	Bethlehem Steel Co	3	876,000
	Swedeland	Alan Wood Steel Co	2	454,800
Total			78	23,563,650

[1] Capacity for ferroalloys totaled 706,800 net tons.

TABLE 4.—Consumption of pig iron and ferrous scrap, 1952–54, by type of furnace, in short tons

Type of furnace and raw material	1952	1953	1954
Open-hearth furnaces:			
Pig iron	14,529,565	17,935,307	12,925,526
Scrap:			
Home	7,206,952	(1)	(1)
Purchased	5,481,996	(1)	(1)
Total	12,688,948	14,066,093	9,430,661
Total pig iron and scrap	27,218,513	32,001,400	22,356,187
Bessemer converters:			
Pig iron	932,761	804,239	529,889
Scrap:			
Home	65,935	(1)	(1)
Purchased	19,523	(1)	(1)
Total	85,458	99,913	84,721
Total pig iron and scrap	1,018,219	904,152	614,610

See footnotes at end of table.

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TABLE 4.—Consumption of pig iron and ferrous scrap, 1952–54, by type of furnace, in short tons—Continued

Type of furnace and raw material	1952	1953	1954
Electric steel furnaces:			
Pig iron	18,197	20,241	13,299
Scrap:			
Home	767,441	(1)	(1)
Purchased	1,011,772	(1)	(1)
Total	1,779,213	1,811,299	1,218,634
Total pig iron and scrap	1,797,410	1,831,540	1,231,933
Cupola furnaces:			
Pig iron	433,106	340,314	286,471
Scrap:			
Home	345,131	(1)	(1)
Purchased	468,636	(1)	(1)
Total	813,767	739,522	642,935
Total pig iron and scrap	1,246,873	1,079,836	929,406
Air furnaces:			
Pig iron	54,303	55,399	40,456
Scrap:			
Home	93,706	(1)	(1)
Purchased	58,013	(1)	(1)
Total	151,719	148,760	109,261
Total pig iron and scrap	206,022	204,159	149,717
Blast furnaces:			
Pig iron			
Scrap:			
Home	659,159	(1)	(1)
Purchased	646,624	(1)	(1)
Total	1,305,783	1,580,139	1,099,013
Total pig iron and scrap	1,305,783	1,580,139	1,099,013
Ferroalloy furnaces:			
Pig iron			
Scrap:			
Home			
Purchased	1,626	1,054	185
Total	1,626	1,054	185
Total pig iron and scrap	1,626	1,054	185
Miscellaneous uses:			
Pig iron	1,058,474	[2] 1,453,354	[2] 805,782
Scrap:			
Home	7,653	(1)	(1)
Purchased	65,098	(1)	(1)
Total	72,751	[2] 59,799	[2] 54,328
Total pig iron and scrap	1,131,225	1,513,153	860,110
Total Pennsylvania:			
Pig iron	17,026,406	20,608,854	14,601,423
Scrap:			
Home	9,145,927	(1)	(1)
Purchased	7,753,288	(1)	(1)
Total	16,899,287	18,506,601	12,639,738
Total pig iron and scrap	33,925,671	39,115,433	27,241,161

[1] Data not available.
[2] Includes small quantity used in crucible furnaces.

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TABLE 5.—Annual steel capacity, January 1, 1955, by type of furnace, in net tons

[American Iron and Steel Institute]

District	Location	Operator	Open hearth		Bessemer		Electric and crucible		Total annual capacity (net tons)
			No.	Annual capacity (net tons)	No.	Annual capacity (net tons)	No.	Annual capacity (net tons)	
Pittsburgh-Youngstown	Aliquippa	Jones & Laughlin Steel Corp	5	1,182,000	3	582,000			1,764,000
		Vulcan Crucible Steel Co					2	9,600	9,600
	Beaver Falls	Babcock & Wilcox Co					4	229,450	229,450
	Brackenridge	Allegheny Ludlum Steel Corp	5	240,000			13	506,700	746,700
	Braddock	United States Steel Corp. (central operations).	16	2,179,000					2,179,000
	Braeburn	Braeburn Alloy Steel Corp					2	20,730	20,730
	Bridgeville	Universal-Cyclops Steel Corp					5	70,160	70,160
	Butler	Armco Steel Corp	6	429,000			1	70,000	499,000
	Carnegie	Union Electric Steel Corp					2	26,760	26,760
	Clairton	United States Steel Corp. (central operations).	12	1,064,000					1,064,000
	Donora	American Steel & Wire Div	13	1,015,000					1,015,000
	Duquesne	United States Steel Corp. (central operations).	12	1,302,000			4	160,000	1,462,000
	Farrell	Sharon Steel Corp	12	1,000,000					1,000,000
	Harmony Twp	Byers Co., A. M					2	75,000	75,000
	Latrobe	American Locomotive Co	3	103,000					103,000
		Latrobe Steel Co					5	24,000	24,000
		Vanadium-Alloys Steel Co					4	12,000	12,000
	McKeesport	Firth Sterling, Inc					3	26,040	26,040
		National Tube Div	3	1,206,000	3	240,000			1,446,000
	Midland	Crucible Steel Co. of America	9	972,000			5	312,000	1,284,000
	Monaca	Colonial Steel Co					2	30,000	30,000
	Monessen	Pittsburgh Steel Co	12	1,404,000					1,404,000
	Munhall	United States Steel Corp. (central operations).	25	3,766,000					3,766,000
	Oakmont	Edgewater Steel Co	3	89,890					89,890
	Pittsburgh	Heppenstall Co	2	50,470			1	5,080	55,550
		Jones & Laughlin Steel Corp	21	3,096,000			1	1,500	3,097,500
	Washington	Jessop Steel Co					4	33,490	33,490
	West Homestead	Mesta Machine Co	4	85,000			1	20,000	105,000

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TABLE 5.—Annual steel capacity, January 1, 1955, by type of furnace, in net tons—Continued

District	Location	Operator	Open hearth		Bessemer		Electric and crucible		Total annual capacity (net tons)
			No.	Annual capacity (net tons)	No.	Annual capacity (net tons)	No.	Annual capacity (net tons)	
Eastern	Bethlehem	Bethlehem Steel Co	31	3,056,000			4	158,000	3,214,000
	Burnham	Baldwin-Lima-Hamilton Corp	5	169,920			1	40	169,960
	Coatesville	Lukens Steel Co	12	750,000					750,000
	Erie	Erie Forge & Steel Corp	5	234,000					234,000
	Fairless Hills	United States Steel Corp. (central operations).	9	2,200,000					2,200,000
	Harrisburg	Central Iron & Steel Co	5	360,000			1	46,000	406,000
		Harrisburg Steel Corp	3	100,750					100,750
	Irvine	National Forge & Ordnance Co					3	25,000	25,000
	Ivy Rock	Alan Wood Steel Co	8	625,000					625,000
	Johnstown	Bethlehem Steel Co	21	2,330,000					2,330,000
		United States Steel Corp. (central operations).	2	19,000			2	6,000	25,000
	Milton	Milton Steel Products Div. Merritt-Chapman & Scott Corp.					2	67,000	67,000
	Philadelphia	Disston & Sons, Inc., Henry					2	25,000	25,000
		Midvale Co	4	146,100			7	201,000	347,100
	Phoenixville	Phoenix Iron & Steel Co	6	432,000					432,000
	Reading	Carpenter Steel Co					7	85,800	85,800
	Steelton	Bethlehem Steel Co	12	1,356,000					1,356,000
Total			286	30,962,130	6	822,000	90	2,240,350	34,024,480

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NONMETALS

Cement.—Production of cement from plants in Pennsylvania decreased 1 percent in 1954 compared with 1953. However, shipments increased 2 percent in tonnage and 3 percent in value. Shipments sold at an average value per barrel of $2.74.

Allegheny, Berks, Butler, Lawrence, Lehigh, Montgomery, Northampton, and York Counties had producing cement plants in 1954. The leading center of production was in Lehigh and Northampton Counties, where 16 plants supplied 70 percent of the cement shipments in 1954. The second center of production was in western Pennsylvania (in Allegheny, Butler, and Lawrence Counties), where 5 plants produced 20 percent of the 1954 shipments.

TABLE 6.—Finished portland cement produced, shipped, and in stock, 1945–49 (average) and 1950–54

Year	Active plants	Production (barrels)	Shipped from mills			Stocks at mills on December 31 (barrels)
			Barrels	Value		
				Total	Average per barrel	
1945–49 (average)	24	30,909,757	30,947,223	$60,264,076	$1.95	2,492,261
1950	24	38,646,260	39,450,611	94,604,230	2.40	2,503,633
1951	24	41,981,431	41,560,431	107,035,506	2.58	2,980,404
1952	24	39,437,971	40,037,761	103,388,586	2.58	2,390,588
1953	24	42,799,409	42,093,765	114,002,846	2.71	3,096,231
1954	24	42,514,803	43,068,234	117,912,299	2.74	2,542,800

TABLE 7.—Shipments of portland cement, 1953–54, by counties

County	1953		1954	
	Barrels	Value	Barrels	Value
Northampton	21,856,592	$59,193,931	22,485,987	$61,507,393
Lehigh	7,810,118	20,867,553	7,712,313	20,519,985
Allegheny, Lawrence, Butler	8,608,573	22,604,891	8,561,019	23,146,906
Berks, Montgomery, York	3,818,482	11,336,471	4,308,915	12,738,015
Total	42,093,765	114,002,846	43,068,234	117,912,299

Clays.—For the third consecutive year, production of clays in Pennsylvania decreased, dropping 1 percent in tonnage compared with 1953, owing mainly to declining production of miscellaneous clay. Production of clay, consisting of fire clay, miscellaneous clay, and kaolin, was reported in 37 counties. Fire clay and kaolin were the most important and represented 84 percent of the value of clay produced in 1954. Fire clay was reported mined in Armstrong, Beaver, Blair, Butler, Cambria, Centre, Clarion, Clearfield, Clinton, Elk, Fayette, Huntingdon, Indiana, Jefferson, Lancaster, Lawrence, McKean, Somerset, and Westmoreland Counties. Miscellaneous clay was reported mined in Adams, Allegheny, Armstrong, Beaver, Berks, Bucks,

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Cambria, Chester, Clarion, Clearfield, Clinton, Columbia, Dauphin, Delaware, Fayette, Greene, Jefferson, Lancaster, Lawrence, Luzerne, Lycoming, McKean, Montgomery, Northumberland, Schuylkill, Snyder, Washington, Westmoreland, and York Counties. Kaolin was produced in Blair and Cumberland Counties. Fire clay was used

TABLE 8.—Clays sold or used by producers, 1945–49 (average), and 1950–54

Year	Kaolin		Fire clay		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	38,428	$142,616	1,634,294	$5,993,405	1,451,269	$1,230,065	3,123,991	$7,366,086
1950	62,626	250,383	1,731,855	7,149,589	1,687,713	1,415,346	3,482,194	8,815,318
1951	75,415	306,045	2,205,794	11,653,734	1,949,358	2,127,771	4,230,567	14,087,550
1952	(1)	(1)	[1] 1,992,099	[1] 10,726,085	1,739,031	1,913,779	3,731,130	12,639,864
1953	(1)	(1)	[1] 1,703,280	[2] 8,001,196	1,872,142	1,986,937	[2] 3,575,287	[2] 9,987,928
1954	(1)	(1)	[1] 1,901,644	[1] 8,602,399	1,622,754	1,641,086	3,524,398	10,243,485

[1] To avoid disclosure of individual company figures, kaolin has been combined with fire clay.
[2] Revised figure.

TABLE 9.—Clays sold or used by producers, in 1953–54, by kinds and uses, in short tons

Use	Fire clay		Miscellaneous clay	
	1953	1954	1953	1954
Refractories:				
Firebrick and block [1]	835,642	[2] 858,165		1,938
Foundries and steelwork	82,410	91,426	13,868	(3)
Miscellaneous refractories	94,334	93,903		
Heavy clay products	642,701	826,231	1,614,017	1,438,936
Paint fillers or extenders			6,640	454
Cement	(3)	(3)	216,923	155,363
Undistributed	[4] 48,193	[4] 31,919	[5] 20,694	[5] 26,083
Total	1,703,280	1,901,644	1,872,142	1,622,754

[1] Includes high-alumina brick.
[2] Includes kaolin.
[3] Included with "Undistributed" to avoid disclosure of individual company operations.
[4] Includes kaolin and fire clays for pottery and stoneware, and other uses.
[5] Includes miscellaneous clay for foundries and steelwork, pottery and stoneware, tile-high grade, miscellaneous fillers, and other uses.

TABLE 10.—Clays sold or used by producers in 1954, by counties

County	Short tons	Value	Percent total	County	Short tons	Value	Percent total
Allegheny	135,898	$251,996	3	Fayette	167,284	$1,030,091	10
Armstrong	170,563	674,972	7	Greene	3,977	4,971	(1)
Beaver	446,113	1,259,979	12	Luzerne	45,284	86,227	(1)
Blair	36,195	127,898	1	Lycoming	434	868	(1)
Cambria	28,909	76,315	1	McKean	107,387	259,714	3
Chester	62,115	77,594	1	Montgomery	69,013	113,905	1
Clarion	88,753	221,815	2	Somerset	63,000	229,198	2
Clearfield	512,724	3,019,912	29	Washington	47,784	57,705	1
Clinton	46,174	237,062	2	Undistributed [2]	1,461,090	2,385,319	23
Cumberland	31,701	177,944	2	Grand total	3,524,398	10,243,485	100

[1] Less than 1 percent.
[2] Includes Adams, Berks, Bucks, Butler, Centre, Columbia, Dauphin, Delaware, Elk, Huntingdon, Indiana, Jefferson, Lancaster, Lawrence, Northumberland, Schuylkill, Snyder, Westmoreland, and York Counties and a quantity unspecified by county.

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principally in producing fire brick and block and heavy clay products, while miscellaneous clay was used mainly in the production of heavy clay products.

Lime.—For the first time in 4 years, the production of lime in Pennsylvania decreased, dropping 19 percent in tonnage and 18 percent in value. Twenty-one companies active in 1954 operated a total of 27 plants in 17 counties. Quicklime and hydrated lime were produced for various uses, of which chemical and industrial were the most important in total value, followed by building, agricultural, and refractory materials.

TABLE 11.—Lime sold by producers, 1945–49 (average) and 1950–54 by uses

Year	Agricultural		Building		Chemical and industrial	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	143,224	$1,394,465	79,484	$1,007,441	761,024	$6,971,331
1950	135,182	1,530,991	134,052	1,944,178	650,756	7,110,931
1951	134,559	1,532,813	126,048	1,740,850	741,673	8,551,011
1952	131,007	1,463,596	123,049	1,675,987	768,319	8,228,875
1953	116,863	1,367,594	114,839	1,575,387	865,747	9,766,852
1954	129,146	1,537,849	120,661	1,697,895	816,044	9,753,519

Year	Refractory		Total	
	Short tons	Value	Short tons	Value
1945–49 (average)	(1)	(1)	983,732	$9,373,237
1950	166,461	$2,076,974	1,086,451	12,663,074
1951	178,820	2,435,380	1,181,100	14,260,054
1952	180,606	2,473,755	1,202,981	13,842,213
1953	237,851	3,300,281	1,335,300	16,010,114
1954	15,732	217,047	1,081,583	13,206,310

[1] Included with chemical and industrial to avoid disclosure of individual company operations.

TABLE 12.—Lime sold or used by producers, 1953–54, by counties

County	1953		1954	
	Short tons	Value	Short tons	Value
Armstrong	955	$11,364	1,159	$15,124
Centre	580,050	6,561,742	487,735	5,573,465
Lebanon	(1)	(1)	194,664	2,040,179
Mifflin	(1)	(1)	5,565	47,000
Montgomery	(1)	(1)	72,661	1,139,504
Snyder	(1)	(1)	3,360	21,949
Somerset	(1)	(1)	1,321	5,284
York	144,187	1,932,181	(2)	(2)
Undistributed	[2] 610,108	[2] 7,504,827	[2] 315,118	[2] 4,363,805
Total	1,335,300	16,010,114	1,081,583	13,206,310

[1] Included with "Undistributed."
[2] Includes tonnage and value for counties that must be concealed as indicated by footnote reference 1 and for the following counties: Bedford, Butler, Chester, Franklin, Fulton, Lancaster, Lycoming (1954), Montour, and Northumberland.

Mica.—Output of mica decreased in 1954 compared with 1953. General Mining Associates remained the sole producer of mica in Pennsylvania. The mica was dried, air-separated, and bagged, mainly for use in paints, rubber, welding rods, and insulation.

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Pyrite.—Output of pyrite decreased in 1954 compared with 1953. Pyrite was produced as a byproduct of Bethlehem Steel Co. iron mining at Cornwall, Lebanon County.

Pyrophyllite (Sericite Schist).—Production of sericite schist decreased 23 percent in tonnage and increased 73 percent in value in 1954 compared with 1953. Output came from one mine in Adams County operated by Summit Mining Corp. and was sold for use as an insecticide filler.

Sand and Gravel.—Production of sand and gravel in 1954 in Pennsylvania decreased 3 percent in tonnage and less than 0.5 percent in value compared with 1953. The sand was produced for use principally as building and paving aggregate. Other uses were as fire or furnace sand, molding sand, engine sand, grinding and polishing

TABLE 13.—Sand and gravel sold or used by producers, 1953–54, by uses

	1953		1954	
	Short tons	Value	Short tons	Value
Sand:				
Molding and fire or furnace	495, 439	$1, 247, 242	439, 741	$982, 139
Building	4, 086, 393	4, 888, 762	3, 598, 674	4, 715, 867
Paving	2, 111, 500	2, 895, 286	2, 163, 749	2, 855, 245
Grinding, polishing, and blast	350, 376	761, 075	(1)	(1)
Engine	220, 136	440, 007	168, 584	398, 243
Glass and filter	611, 168	1, 906, 436	(1)	(1)
Other	205, 944	454, 209	958, 522	3, 086, 096
Total sand	8, 080, 956	12, 593, 017	7, 329, 270	12, 037, 590
Gravel:				
Building	3, 917, 298	4, 835, 198	3, 523, 242	4, 873, 109
Paving	2, 578, 982	3, 096, 656	3, 301. 277	3, 599, 913
Railroad ballast	57, 956	31, 850	(1)	(1)
Other	80, 191	135, 670	64, 655	85, 378
Total gravel	6, 634, 427	8, 099, 374	6, 889, 174	8, 558, 400
Grand total	14, 715, 383	20, 692, 391	14, 218, 444	20, 595, 990

[1] Included with "Other" to avoid disclosure of individual company operations.

TABLE 14.—Sand and gravel sold or used by producers, 1953–54, by counties

County	1953		1954	
	Short tons	Value	Short tons	Value
Allegheny	1, 176, 987	[1]$2, 328, 900	(2)	(2)
Beaver	1, 399, 061	1, 778, 693	981, 212	$1. 170, 481
Bucks	4, 622. 674	5, 518, 309	5, 305, 524	8, 103, 521
Carbon	330, 246	439, 022	336, 780	476, 048
Crawford	104, 360	146, 127	224, 929	181, 507
Dauphin	344, 704	74, 509	513, 868	154, 401
Erie	399, 233	471, 688	232, 826	251, 927
Luzerne	299, 166	381, 170	392, 347	438, 969
Somerset	1, 249	2, 355	(2)	(2)
Undistributed [3]	6, 037, 703	[1] 9, 551, 618	6, 230, 958	9, 819, 136
Total	14, 715, 383	20, 692, 391	14, 218, 444	20, 595, 990

[1] Revised figure.
[2] Included with "Undistributed."
[3] Includes tonnage and value for counties that must be concealed, as indicated by footnote reference 2, and for the following counties: Armstrong, Bedford, Berks, Blair, Bradford, Cameron (1954), Clearfield, Columbia, Cumberland (1954), Fayette, Forest (1954), Franklin, Huntingdon, Lancaster, Lawrence, Lycoming, McKean, Mercer, Mifflin, Monroe, Montgomery, Montour (1954), Northampton, Northumberland, Philadelphia, Pike (1954), Schuylkill (1954), Venango, Warren, Wayne, and Wyoming.

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sand, blast sand, glass sand, and filter sand. Gravel was sold for use as building and paving aggregate and railroad ballast. Production came from 41 counties; Buck County ranked first, followed by Armstrong, Beaver, and Lycoming Counties.

Slate.—The production of slate in 1954 in Pennsylvania decreased slightly in tonnage (4 percent) and value, compared with 1953. Slate was sold for 10 principal uses such as: Flour, granules, roofing, flagging, structural and sanitary, and blackboards and bulletin boards. Production came from Northampton (leading producer), Lehigh, and York counties.

TABLE 15.—Slate sold by producers, 1945–49 (average) and 1950–54, by uses

Year	Number of operators	Roofing		Millstock		Other uses	Total value
		Squares (100 square feet)	Value	Square feet	Value	Value	
1945–49 (average)	22	114,134	$1,812,937	2,074,986	$891,673	$1,170,485	$3,875,095
1950	27	124,280	2,341,127	2,724,450	1,559,587	1,645,300	5,546,014
1951	25	134,180	2,681,072	2,589,090	1,416,657	1,591,141	5,688,870
1952	18	93,200	1,866,479	2,078,020	1,227,471	1,393,698	4,487,648
1953	18	86,116	1,688,167	2,363,266	1,452,320	1,279,125	4,419,612
1954	17	77,819	1,487,870	2,505,839	1,616,981	1,314,588	4,419,439

Stone.—Production of stone in Pennsylvania in 1954 increased 55 percent in tonnage and 27 percent in value over 1953. Sandstone, granite, basalt, limestone, and miscellaneous stone were produced in 44 counties. Of the total value, sandstone represented 7 and limestone 82 percent.

Sandstone was marketed as both dimension and crushed stone. Dimension sandstone was prepared as rough construction, rubble, rough architectural, and flagging stone. Crushed sandstone was used as road material and ganister rock. The ganister rock was used by refractory plants in the State in manufacturing silica brick.

Only dimension granite was produced from quarries in Pennsylvania in 1954. It was used principally as building stone in the form of rough construction or dressed architectural.

Both dimension and crushed basalt were produced in 1954. Dimension basalt was produced from a quarry in Chester County. Crushed basalt was produced in Adams, Berks, Bucks, Chester, Delaware, and Montgomery Counties and used principally as road material and railroad ballast.

Dimension limestone was produced in Bucks, Chester, Lancaster, and Somerset Counties for use in rough construction and as rubble. Government-and-contractor limestone was produced by the Pennsylvania Turnpike Commission in Bedford County and as road material in Dauphin County by the Pennsylvania Department of Highways. Crushed limestone was produced in 35 counties and used as a fluxing agent, concrete aggregate, and railroad ballast and for agricultural purposes.

Quantities of various miscellaneous stones such as serpentine, soapstone, gneiss, and mica schist were quarried for local use in 1954.

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TABLE 16.—Stone sold or used by producers, 1953–54, by uses

Use	1953		1954	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone, short tons	[1] 142,795	[1] $749,909	153,774	$798,270
Monumental stone, cubic feet	[2]	[2]	[2]	[2]
Curbing and flagging, cubic feet	78,205	131,046	65,785	122,902
Total dimension stone (approximate equivalent in short tons)	[1] 148,947	[1] 880,955	159,270	921,172
Crushed and broken stone:				
Riprap, short tons	[3] 164,096	[3] 253,169	[2]	[2]
Crushed stone, do	13,594,967	20,093,938	16,544,373	23,924,243
Furnace flux (limestone), do	9,351,478	16,514,344	6,483,488	10,857,065
Refractory, do	588,583	3,481,474	496,848	2,247,516
Agricultural (limestone), do	895,093	2,712,796	887,684	2,787,111
Other uses, do	[3] 1,426,249	[3] 3,849,745	15,945,210	20,430,392
Total crushed and broken stone, do	26,020,466	46,905,466	40,357,603	60,246,327
Undistributed	23,194	307,608	4,883	25,920
Grand total	[1] 26,192,607	[1] 48,094,029	40,521,756	61,193,419

[1] To avoid disclosing confidential information, certain totals are incomplete.
[2] Included with "Undistributed."
[3] Incomplete, the portion not included being combined as "Undistributed."

TABLE 17.—Stone sold or used, 1953–54, by counties

County	1953		1954	
	Short tons	Value	Short tons	Value
Adams	1,709,564	$2,840,907	[1]	[1]
Allegheny	[1]	[1]	2,384	$16,687
Berks	1,285,947	1,921,930	2,696,525	2,675,091
Blair	719,042	1,553,391	739,439	1,380,314
Bucks	545,824	1,077,378	596,794	1,159,742
Butler	1,637,341	3,047,082	[1]	[1]
Centre	946,361	1,962,012	1,740,967	3,139,442
Chester	904,541	1,511,107	1,881,649	2,651,785
Clinton	184,312	273,705	200,661	283,625
Cumberland	425,797	620,492	[1]	[1]
Dauphin	1,011,884	1,573,146	1,001,069	1,620,432
Delaware	867,486	1,489,690	751,939	1,195,829
Fayette	26,797	92,020	[1]	[1]
Franklin	386,469	558,009	507,778	782,062
Huntingdon	706,762	2,522,074	422,953	1,249,564
Indiana	[1]	[1]	3,174	13,954
Juniata	102,109	187,889	117,394	157,563
Lancaster	1,402,481	2,306,854	1,447,783	2,404,485
Lawrence	2,109,010	4,999,865	2,865,643	4,489,297
Lebanon	1,176,502	1,956,494	2,120,169	3,504,360
Lehigh	214,221	324,997	2,424,223	2,377,604
Lycoming	354,559	620,425	339,272	585,135
Mifflin	992,458	1,132,528	708,959	1,011,575
Monroe	77,717	170,336	[1]	[1]
Montgomery	2,428,403	4,173,198	3,310,373	5,315,096
Northampton	[1]	[1]	7,092,538	7,032,948
Northumberland	[1]	[1]	114,000	201,650
Perry			72,118	114,668
Schuylkill	24,362	82,479	23,553	167,848
Snyder	[1]	[1]	82,488	181,511
Susquehanna	[1]	[1]	88,832	227,988
Union	[1]	[1]	205,400	358,100
Westmoreland	303,846	778,761	[1]	[1]
York	1,112,710	2,526,760	2,156,892	3,822,708
Undistributed	[2] 4,536,102	7,790,500	6,806,787	13,072,356
Total	[3] 26,192,607	[3] 48,094,029	40,521,756	61,193,419

[1] Included with "Undistributed."
[2] Includes tonnage and value for counties indicated by footnote reference 1 and for the following counties: Armstrong, Bedford, Fulton, Greene (1954), Lackawanna (1954), Luzerne, Mercer, Montour, Potter (1954), and Somerset.
[3] To avoid disclosing confidential information, total is incomplete.

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Sulfur.—Output of byproduct sulfur increased in quantity and in value in 1954 compared with 1953. Recoverable elemental sulfur, as reported by producing companies in Pennsylvania, consisted of brimstone recovered as a byproduct in the liquid purification of gas. In addition, quantities of hydrogen sulfide were recovered.

Tripoli.—The tripoli produced in Pennsylvania was a rottenstone mined from open pits at Antes Fort and Muncy in Lycoming County; it was dried and ground for use as an abrasive material and a filler in phonograph records. Output of tripoli in 1954 decreased slightly in tonnage compared with 1953 but increased in total value.

REVIEW BY COUNTIES

Production of metals and nonmetals in 1954 was reported in 65 of the 67 counties in Pennsylvania. Coal was produced in 37 counties in 1954. A discussion of metals, nonmetals, and coal by counties is given below. Production of petroleum, natural gas, and natural-gas liquids in Pennsylvania is not covered in the county descriptions.

Adams.—The Hanover quarry at Hanover was operated by Bethlehem Quarry Co. for limestone for blast-furnace-flux use, road material, and agricultural purposes.

Miscellaneous clay was produced by Alwine Brick Co., New Oxford, and Gettysburg Drain Tile Works, Gettysburg, for use in manufacturing heavy clay products.

The Funkhouser Co. produced roofing granules and stone flour at Charmian.

Sericite schist was produced by Summit Mining Corp., Bendersville, for use in insecticides.

Allegheny.—The Pittsburgh Coke & Chemical Co. operated a cement plant on Neville Island. Universal Atlas Cement Co., a subsidiary of United States Steel Corp., operated the Universal Plant. Production at both plants consisted of air-entrained and non-air-entrained cement.

Leading producers of bituminous coal in 1954 were Allegheny Pittsburgh Coal Co., William Aloe Coal Co., Butler Consolidated Coal Co., Campbell Coal Co., Duquesne Light Co., Greensburg-Connellsville Coal & Coke Co., Harmar Coal Co., Pittsburgh Coal Co., Renton Coal Co., and Republic Steel Corp. Bituminous coal was produced both by underground and strip-mining methods.

Bank-run sand for use as molding sand was produced by James H. McCrady Sand Co., Acmetonia, and Sidwell Loam Sand Co., Cheswick (Acmetonia). The Sand & Gravel, Inc., operated a dredge for producing sand for structural and paving purposes.

Six companies, Milliken Brick Co., Inc. (Wilkinsburg), Van Ormer Brick Co., Inc. (Pitcairn), McFetridge Bros. Brick Co. (Creighton), M. Lanz Brick & Tile Co. (Pittsburgh), Glassmere Brick & Tile Co. (Glassmere), and Bridgeville Brick Co. (Bridgeville), produced miscellaneous clay from open-pit mines. All the production was reported as used in the manufacture of heavy clay products, including building brick and tile, paving brick, drain tile, and sewer pipe.

Sandstone for use as rubble was produced by Francis Matesia near Cuddy.

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TABLE 18.—Value of mineral production in Pennsylvania, 1953–54, by counties [1] [2]

County	1953	1954	Minerals produced in 1954 in order of value
Adams	(3)	(3)	Stone, clays, sericite schist.
Allegheny	$68,689,537	$47,237,526	Coal, cement, sand and gravel, clays, stone.
Armstrong	18,257,287	12,887,775	Coal, sand and gravel, stone, clays, lime.
Beaver	4,404,121	4,127,840	Coal, clays, sand and gravel.
Bedford	(3)	(3)	Stone, coal, lime, sand and gravel.
Berks	6,981,802	[4] 8,125,686	Cement, stone, clays, sand and gravel.
Blair	2,514,949	2,243,120	Stone, coal, clays, sand and gravel.
Bradford	(3)	(3)	Sand and gravel, coal.
Bucks	6,615,801	9,283,263	Sand and gravel, stone, clays.
Butler	15,717,723	12,402,225	Coal, cement, stone, lime, clays.
Cambria	(3)	54,433,637	Coal, clays.
Cameron	202,536	(3)	Coal, sand and gravel.
Carbon	15,737,578	12,058,552	Do.
Centre	12,961,879	10,371,114	Lime, coal, stone, clays.
Chester	3,079,500	3,956,879	Stone, lime, clays.
Clarion	8,252,830	6,884,248	Coal, clays.
Clearfield	26,956,739	(3)	Coal, clays, sand and gravel.
Clinton	2,334,426	2,796,862	Coal, stone, clays.
Columbia	(3)	(3)	Coal, sand and gravel, clays.
Crawford	146,127	181,507	Sand and gravel.
Cumberland	620,492	(3)	Stone, clays, sand and gravel.
Dauphin	3,430,355	1,949,554	Stone, coal, sand and gravel, clays.
Delaware	1,738,981	1,498,374	Stone, sulfur, clays.
Elk	(3)	(3)	Coal, clays.
Erie	814,429	251,927	Sand and gravel.
Fayette	(3)	41,568,911	Coal, clays, sand and gravel, stone.
Forest	----------	(3)	Sand and gravel.
Franklin	756,356	871,121	Stone, sand and gravel, lime.
Fulton	(3)	(3)	Coal, stone, lime.
Greene	(3)	(3)	Coal, stone, clays.
Huntingdon	5,768,138	4,503,817	Sand and gravel, stone, coal, clays.
Indiana	(3)	(3)	Coal, clays, stone.
Jefferson	(3)	(3)	Coal, clays.
Juniata	187,889	157,563	Stone.
Lackawanna	40,661,196	(3)	Coal, stone.
Lancaster	4,442,736	[4] 2,851,943	Stone, sand and gravel, lime, clays,
Lawrence	15,982,552	14,323,801	Cement, stone, coal, sand and gravel, clays.
Lebanon	19,578,767	[4] 16,539,086	Iron ore, stone, lime, copper, cobalt, pyrite, gold, silver.
Lehigh	21,467,115	21,016,605	Cement, stone, slate.
Luzerne	109,025,467	98,416,288	Coal, stone, sand and gravel, clays.
Lycoming	1,577,791	1,379,065	Sand and gravel, stone, coal, tripoli, lime, clays.
McKean	(3)	(3)	Coal, clays, sand and gravel.
Mercer	(3)	(3)	Coal, sand and gravel, stone.
Mifflin	(3)	1,949,753	Stone, sand and gravel, lime.
Monroe	(3)	(3)	Stone, sand and gravel.
Montgomery	8,906,414	9,282,824	Stone, cement, lime, clays, sand and gravel.
Montour	522,062	(3)	Stone, lime ,sand and gravel.
Northampton	63,990,491	[4] 65,728,778	Cement, slate, stone, sand and gravel.
Northumberland	36,077,811	30,730,257	Coal, stone, clays, sand and gravel.
Perry	----------	114,668	Stone.
Philadelphia	(3)	(3)	Sand and gravel.
Pike	----------	(3)	Do.
Potter	----------	(3)	Stone.
Schuylkill	(3)	69,458,677	Coal, sand and gravel, stone, clays.
Snyder	155,233	[4] 251,007	Stone, clays, lime.
Somerset	21,305,181	12,584,983	Coal, stone, clays, sand and gravel, lime.
Sullivan	----------	132,841	Coal.
Susquehanna	(3)	227,988	Stone.
Tioga	(3)	354,608	Coal.
Union	(3)	358,100	Stone.
Venango	(3)	(3)	Coal, sand and gravel.
Warren	(3)	(3)	Sand and gravel.
Washington	(3)	78,505,987	Coal, clays.
Wayne	(3)	(3)	Sand and gravel.
Westmoreland	27,424,760	16,164,974	Coal, stone, clays.
Wyoming	(3)	(3)	Sand and gravel.
York	8,761,070	9,403,485	Stone, cement, lime, slate, sand and gravel, clays, mica.
Undistributed	535,573,748	237,977,639	
Total	1,121,622,000	925,545,000	

[1] Excludes value of production for LP-gases, natural gas, natural gasoline, peat, and petroleum by counties, but included with "Undistributed."
[2] Excludes value of clays and stone used in the manufacture of lime and cement.
[3] Value included with "Undistributed."
[4] Excludes value of anthracite which is included with "Undistributed" to avoid disclosure of individua company figures.

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Armstrong.—Sand and gravel was produced by Glacial Sand & Gravel Co., Parrtown; Allegheny Sand & Loam Co., Leechburg; and Lee Don, Inc., Manorville Sands Division, Manorville. J. K. Davison & Bros. operated a dredge on the Allegheny River in Armstrong County for producing sand and gravel.

Michigan Limestone Division, United States Steel Corp., operated the Kaylor mine, East Brady, and Buffalo Creek mine, Worthington, in 1954. The plant at the Buffalo Creek mine was abandoned during the year. The limestone was used for flux, road material, cement, and agricultural purposes.

Eight companies produced clay in 1954 in Armstrong County. Continental Clay Products Co (Kittanning), Freeport Brick Co. (Freeport), Kittanning Refractories, Inc. (Kittanning), Graff-Kittanning Clay Products Co. (Worthington), Harbison-Walker Refractories Co. (Templeton), Haws Refractories Co. (Kittanning), Kittanning Brick Co. (Adrian), and Worthington Ceramics Co. (Worthington) produced plastic fire clay. In addition, Kittanning Refractories, Inc., produced miscellaneous clay. Graff-Kittanning Clay Products Co. and Worthington Ceramics Co. produced clay from an open pit; and Kittanning Refractories, Inc., produced from both underground and open-pit mines; the other five companies produced from underground mines.

Three companies, all near Kittanning, produced lime in 1954. C. D. McCanna in Valley Township, produced both quicklime and hydrated lime for agricultural use. Craig Claypool (Manor Township) and Walter Hershberger operated plants for the production of agricultural hydrated lime.

Leading producers of bituminous coal in 1954 were Allegheny River Mining Co., Harl E. Bowser Coal Co., Compton Coal Co., J. Russell Cravener Coal Co., Heffelfinger Coal Co., Iseman Bros. Coal Co., Leechburg Mining Co., Maral Co., Meck Mining Co., and Joe F. Sherman Coal Co. Bituminous coal was produced from both strip and underground mines.

Beaver.—Negley Fire Clay Co. (New Galilee), Davis Coal Co. (Darlington), Ralph A. Veon, Inc. (Darlington and New Galilee), Pen-Hio Clay Co. (Cannelton), and Sunnyside Coal Mining Co. (Darlington) produced and sold fire clay from open-pit mines. Production of fire clay from underground mines was reported by McLain Fire Brick Co., Beaver; Standard Clay Mfg. Co., Fallston; and Colonial Clay Products Co., Fallston. Metropolitan Clay, Inc., Darlington, produced fire clay from an open pit. Eastvale Clay Products Co., Beaver Falls, produced fire clay from an underground mine for use at its local plant and also for sale on the open market. Brighton Clay Products Co., New Brighton, and Friedl-Elverson Pottery Co. produced miscellaneous clay from open pits; in addition, Friedl-Elverson Co. produced fire clay. Fire clay produced in Beaver County was used in producing refractories and heavy clay products. The miscellaneous clay was used in manufacturing art pottery, flowerpots, glaze slip, and heavy clay products.

Sand and gravel was produced by open-pit methods by Shippingport Sand & Gravel Co. and Beaver Sand Co. Ellwood Stone Co. produced only sand. Dravo Corp., Keystone Division, and Iron City Sand & Gravel Corp. dredged sand and gravel from the Ohio River.

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Leading producers of bituminous coal in 1954 were C & S Coal Co., Colonial Gas Coal Co., Courtney Coal Co., Dow-Lin Coal Co., Keystone Valley Coal Co., Lake Erie Coal Co., Negley Fire Clay Co., North Sewickley Coal Co., Sunnyside Coal Co., and Tasa Coal Co. Bituminous coal was produced by underground and strip-mining methods.

Bedford.—The Leap Ganister Rock Co. produced ganister from a quarry near Hyndman. The Ashcom, Everett quarry was worked by the New Enterprise Stone & Lime Co., Inc., for limestone usable for road material and agricultural purposes. Limestone for use as road material was produced by the Pennsylvania Turnpike Commission in Bedford County.

Hydrated lime, for agricultural purposes and for use in manufacturing silica brick, was produced by the New Enterprise Stone & Lime Co., Inc., at a plant near Everett. J. Mason Kerr operated the Gravel Pit Kilns near Hyndman to produce agricultural quicklime.

Feight Bros. crushed and screened bank-run sand for use as building sand.

Leading producers of bituminous coal in 1954 were C. E. Clark Contracting Co., Colledge Coal Co., Lumsted Coal Co., Martin, McIntyre & McKnight, Rockhill Coal Co., and Rohm Coal Co. Bituminous coal was produced by both underground and open-pit methods.

Berks.—Cement rock and limestone were produced by Allentown Portland Cement Co. near Oley and Evansville for use at its Evansville cement plant.

The John T. Dyer Quarry Co. produced diabase traprock for use as road material and railroad ballast from the Monocacy and Birdsboro quarries near Birdsboro. Basalt was also produced near Oreland by Stove Traprock Co. for construction use. Berks Products Corp., Reading, produced crushed limestone for use as road material. Eastern Lime Corp. worked the Hinterleiter quarry near Kutztown for limestone usable in manufacturing cement and for paving and agricultural purposes. E. J. Breneman, Inc., sold crushed limestone as road material from a quarry in Spring Township.

Schildt Bros., Temple, and John H. Gring, Sinking Spring (Spring Township), crushed and screened bankrun sand and gravel for use as building material.

Glen-Gery Shale Brick Corp. produced miscellaneous clay for use at its Shoemakersville and Wyomissing brick plants from open-pit mines.

Blair.—Quartzite was produced by Basalt Trap Rock Co., Williamsburg; General Refractories Co., Clarksburg; and J. L. Hartman Co., Sproul. The ground rock was used in the production of silica brick as road material, riprap, and railroad ballast. Limestone was produced by New Enterprise Stone & Lime Co., Inc. (Roaring Spring and Hollidaysburg), Sproul Lime & Stone Co. (Claysburg), John A. Ellenberger (Eldorado Quarry, Altoona), and Chimney Rocks Lime & Stone Co. (Hollidaysburg), mainly for road material. A small quantity was sold for the production of lime.

Fire clay was produced from open pits by Woodbury Clay Co. (Williamsburg), Blair Clay Products Co. (Altoona), and Garfield Refractories Co. (Cresson), for use in producing firebrick and fire-clay

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mortar. Kaolin, for use in the production of firebrick and block, was produced by Grannas Bros. at the No. 1 mine near Williamsburg.

Bank-run sand was produced by Frankstown Sand Supply Co. and George H. Trude, both at Hollidaysburg, for use as structural material.

Producers of bituminous coal in 1954 were Argyle Coal Co., Burkhart Coal Co., Cavalier Coal Co., Inc., Lawrence Sherbine, and Stone Bridge Coal Co. Bituminous coal was produced by stripping and underground methods.

Bradford.—Karl D. Shiner processed bank-run sand for use as building and paving sand. Quantities of gravel for use as building and paving material were also produced. The Pennsylvania Department of Highways produced gravel for use in paving construction.

The only producer of bituminous coal in 1954 was Mott Coal Co.; the total production was produced by stripping methods.

Bucks.—Durnan & Good (Upper Black Eddy), Tullytown Sand & Gravel Co. (Tullytown), and Riegelsville Sand & Gravel Co. (Riegelsville) processed bank-run sand and gravel for building and paving purposes. Amico Sand & Gravel Co., Morris, produced sand and gravel from a wet pit for use as building material, and Brennan Sand Co., Tullytown, produced bank sand for use as molding sand. A. L. Lewis operated a dry pit near New Hope for producing building sand and building and paving gravel. The Warner Co. was active in dredging sand and gravel from the Delaware River and from Van Seiver Lake. This material was used as building and paving material.

Dimension granite was produced by Coopersburg Granite Co., Inc. Crushed basalt for road material and railroad ballast was produced by the General Crushed Stone Co., Quakertown, and by David D. Derstine, Telford. Rubble (limestone) was produced from an open quarry in Middletown Township by Karpinski Stone Quarry Co. Limestone as road material was quarried by New Hope Crushed Stone Lime Co., New Hope; Locust Point Stone Quarries, Mechanicsburg; and Bituminous Service Co., Buckingham. Miscellaneous building stone and crushed stone were produced by C. Ducciarelli & Sons at Edison, and crushed miscellaneous stone (bluestone) as road material was produced by George Wiley at Point Pleasant.

Miscellaneous clay was produced near Quakertown by the Quakertown Brick & Tile Co., Inc., for use at its local plant in producing heavy clay products.

Butler.—Penn-Dixie Cement Corp. produced non-air-entrained cement by the wet process at its West Winfield Cement plant. This company produced limestone, shale, and sand for use as raw material.

Limestone for agricultural purposes was produced by Grove City Limestone Co. at Branchton. In addition to limestone as road material, the Michigan Limestone Division, United States Steel Corp., produced limestone from the Annandale mine, Boyers, for use in manufacturing cement and as fluxing material.

The Mercer Lime & Stone Co., Branchton, produced both quicklime and hydrated lime, principally for use in open-hearth and electric furnaces, for water purification, and as agricultural lime.

Pittsburgh & Erie Coal Co. produced plastic fire clay from a pit near Claytonia for sale to manufacturers of refractories.

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Leading producers of bituminous coal in 1954 were Allison Engineering Co., Butler Consolidated Coal Co., Carbon Coal Co., Inc., Chutz Bros. Coal Co., Clarion Coal Mining Co., De Marsh Coal Co., Kerry Coal Co., Linda Coal & Supply Co., Sunbeam Coal Corp., and Tri-County Fuel Co. Bituminous coal was produced both by underground- and strip-mining methods.

Cambria.—Fire clay was produced from underground mines by Patton Clay Mfg. Co. (Patton), Hiram Swank's Sons, Inc. (South Fork), and Harbison-Walker Refractories Co. (Blandburg) for use in manufacturing refractories. A small quantity of miscellaneous clay was produced by Triangle Clay Products Co. from an open pit near Johnstown.

Leading producers of bituminous coal in 1954 were Barnes & Tucker Coal Co., Berwind-White Coal Mining Co., Bethlehem Mines Corp., Eastern Gas & Fuel Associates, Ebensburg Coal Co., Johnstown Coal & Coke Co., Pennsylvania Coal & Coke Corp., C. E. Powell Coal Co., Rich Hill Coal Mining Co., and Sterling Coal Co. Bituminous coal was produced by underground- and strip-mining methods.

Cameron.—Thomson & Montgomery operated a quarry and fixed plant near Shippen Township, Emporium, for producing quantities of sand usable as concrete aggregate.

John E. Rydesky and S. Brake Slyder produced bituminous coal in 1954 at stripping operations.

Carbon.—The Alliance Sand Co. at Palmerton quarried sand usable as paving, building, furnace, and engine sand. Stony Ridge Silica Corp. produced sand from a quarry near Little Gap for use as building and furnace sand while the Butz Lumber Co. produced paving sand from a quarry near Palmerton. Wagner Sand Co., Inc. processed bank-run sand from a pit near Hazleton for use as paving material and engine sand. A small quantity of paving gravel also was produced in Carbon County.

Leading producers of anthracite were Beaver Meadow Mining Co., Coaldale Mining Co., Inc., John G. Connell, Glen Alden Coal Co., Jackson Coal Co., Lehigh Navigation Coal Co., Panther Valley Coal Co., Payne Coal Co., Penn Rich Contracting Co., and Weston Dodson & Co., Inc.

Centre.—Two companies (National Gypsum Co. and Warner Co. both of Bellefonte) produced quicklime and hydrated lime. The Standard Lime & Stone Co., Pleasant Gap, produced only hydrated lime. The lime was sold for various uses, of which the more important were in open-hearth furnaces, electric furnaces, and in manufacturing paper. H. R. Greist Mineral Co., State College, produced sulfur mud.

Quartzite, produced by McFeely Brick Co. from a quarry at Port Matilda, was shipped to its Latrobe plant for use in producing silica brick. Five companies produced limestone from quarries in Centre County. National Gypsum Co. operated an open-pit mine and Warner Co. an underground mine for limestone for use mainly in manufacturing lime and road material. Five miles south of Bellefonte in Pleasant Gap, Whiterock Quarries produced limestone from an open quarry, and Standard Lime & Stone Co. produced from an underground mine. Both companies operated crushing plants and sold crushed limestone as flux, road material, and for agricultural

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purposes. The Valley View Lime Co. operated the Miller quarries and crushing plant in Marion Township for producing fluxing limestone.

Fire clay of the flint variety was produced from an underground mine by General Refractories Co., Orviston, and from an open-pit mine by J. H. France Refractories Co., Snow Shoe. This clay was used in the production of firebrick.

Producers of bituminous coal in 1954 were Robert Bailey, R. S. Carlin, Inc., Cherry Run Coal Mining Co., Inc., Elliot Coal Mining Co., H & R Coal Co., Michael Koshko, Joseph A. Padisak, Rice Bros. Coal Co., River Hill Coal Co., and Rougeux, Trimpey, and Rougeux Coal Co. Bituminous coal was produced from both underground and strip mines.

Chester.—Dimension sandstone was produced from quarries by Albert Rotunno, New Garden Township, West Grove; Alfred V. Mouldar, and Abram T. Minor, both of Avondale; and Bacton Hill, Malvern. Dimension basalt for rough construction purposes was produced by French Creek Granite Co. near St. Peters. Rushland Quarry produced basalt and sold crushed basalt as riprap and road material. W. E. Johnson, Inc., operated a quarry near Paoli for the production of dimension limestone for rough construction purposes and crushed limestone as road material. The only other limestone producer in Chester County was the Warner Co., operating the Cedar Hollow quarry near Devault. The company used the limestone for producing quicklime and hydrated lime mainly for building and agricultural use, and in sewage and tradewaste treatment. Quantities of limestone also were sold as flux and road material.

Miscellaneous clay for manufacturing building brick was mined by McAvoy Vitrified Brick Co., Phoenixville, and by Phillip D. Cope near Sylmor for use in manufacturing flowerpots.

Bradford Hills Quarry, Inc., produced miscellaneous stone for concrete aggregate.

Clarion.—Frank B. Pope Co., New Bethlehem, and Climax Fire Brick Co., Climax, produced both plastic and flint fire clays. McLain Fire Brick Co., Division of H. K. Porter Co., Inc., St. Charles, produced only plastic fire clay. Lucinda Clay Co., William Judy & Sons, and J. F. Eisworth Estate, all at Lucinda, produced flint fire clay. New Bethlehem Tile Co. produced both plastic fire clay and miscellaneous clay for use in the manufacture of heavy clay products.

Leading producers of bituminous coal in 1954 were Allison Engineering Co., Mac Coal Co., Mays Coal Co., Joe F. Sherman Coal Co., Harold A. Siegel Coal Co., W. Pershing Stahlman, G. A. Stiles & Co., West Freedom Mining Co., Wingert Contracting Co., Inc., and Zackerl Coal Co. Bituminous coal was produced both from underground and strip mines.

Clearfield.—Clearfield County ranked first among Pennsylvania counties in the production of clays in 1954. Production from Clearfield County consisted of fire clay and miscellaneous clay. Thirteen companies produced fire clay in 1954; 7 produced plastic fire clay, 4 flint fire clay, and 2 both varieties. Of the companies producing plastic fire clay, only Hiram Swank's Sons, Inc. (Boardman), and Laclede-Christy Co. (Clearfield) produced from underground mines. Thomas Bros. Coal Co. (Curwensville), W. K. Turner & Sons (Wallaceton)

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and Artie K. Baughman (Bigler) marketed their entire production of plastic fire clay. Williamsgrove Clay Products Co. (Bigler), Clearfield Clay Products Co. (Curwensville) Hiram Swank's Sons, Inc. (Boardman) and Laclede-Christy Co. (Bigler) produced clay for their own use. Six of the 7 companies produced the fire clay for use in manufacturing firebrick and block, and the other company used the clay in manufacturing heavy clay products. North American Refractories Co. (Curwensville, Grampian, and Luthersburg) General Refractories Co. (Clearfield) T. & T. Clay Co. (West Decatur), and Swistock & George (Fanbourn) produced flint fire clay in Clearfield County. North American Refractories Co. and General Refractories Co. operated underground mines for flint fire clay, but the other companies produced from open-pit mines. The entire production of flint fire clay was used in manufacturing refractories. Both plastic and flint fire clays were produced from underground and open-pit mines by Laclede-Christy Co. from mines near Clearfield and Osceola Mills and by Harbison-Walker Refractories Co. near Clearfield. Production from these mines was used in manufacturing refractories. Robinson Clay Products Co. operated an open-pit mine near Clearfield, producing plastic fire clay and miscellaneous shale for use by the company in producing heavy clay products.

Bells Landing Sand & Gravel, Bells Landing, and Mervyl and Kathryn Yeager produced sand and gravel for use as paving and building material.

Leading producers of bituminous coal in 1954 in Clearfield County were Robert Bailey Benjamin Coal Co., Bradford Coal Co., Cambria-Clearfield Mining Co., Howard Coal Mining Co., Imperial Coal Corp., Lingle Coal Co., Morrisdale Coal Mining Co., Pennbrook Contracting Corp., River Hill Coal Co., and Stinard Coal Co. Bituminous coal was produced from both underground and strip mines.

Clinton.—Fire clay was mined by General Refractories Co., Beech Creek; Kelsey Mining Co., Gallagher Township; and North American Refractories Co., Lock Haven. Kelsey Mining Co. produced from an open pit, but the other two companies operated underground mines. Miscellaneous clay was produced from an open pit by Mill Hall Clay Products, Inc., Castanea.

The Lycoming Silica Sand Co. operated a quarry and crusher at Salona, and sold the crushed limestone as road material and railroad ballast.

Leading producers of bituminous coal in 1954 were Joseph Antosh, Harry J. Batschelet Estate, C. V. Fink & Son, Lloyd Holmes, Parson Bros., Pennbrook Contracting Co., Burton & Joseph Peters, John E. Teeter, Veres Bros., and D. G. Wertz Coal Co. Bituminous coal was produced from both underground and strip mines.

Columbia.—The Bloomsburg Sand & Gravel Co., Scott Township, was the only producer of sand and gravel in Columbia County marketing the material for building purposes.

Miscellaneous clay was produced by Alliance Clay Products Co. from a pit near Mifflinville for use in producing heavy clay products.

Leading producers of anthracite in 1954 were Centralia Mining Co., Hazle Brook Coal Co., L. & M. Coal Co., Philadelphia & Reading Coal & Iron Co., Pine Ridge Mining Co., Raven Run Coal Co.,

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Rooster Coal Co., Scotch Valley Sales Co., Sullivan Trail Coal Co., and Susquehanna Collieries Division of M. A. Hanna Co.

Crawford.—Bank-run sand and gravel was mined and processed by W. L. Dunn (Cochranton), Moyers Bros. Sand & Gravel Supply Co. (Sadsbury Township (Conneaut Lake)), Hasbrouck Sand & Gravel (Titusville), Meadville Supply Co. (Woodcock Township (Saegertown)), and Fairfield Sand & Gravel Co. (Fairfield Township (Cochranton)) for use as structural and paving material. A small quantity of gravel was produced by the Pennsylvania Department of Highways in Crawford County.

Cumberland.—Limestone was produced by Hempt Bros. (Camp Hill), Valley Quarries, Inc. (Shippensburg), and R. W. Smith & Sons (Bowmansdale) and was sold as crushed limestone for road material.

This county was a major source of kaolin in Pennsylvania in 1954. An open pit near Mount Holly Springs was operated by the Philadelphia Clay Co., and the kaolin was used as a cement whitener.

Raymond A. Bender & Son, Dickenson Township, processed bank-run sand for use as building material. C. & L. Goodhart, Walnut Bottom, produced both sand and gravel.

Dauphin.—Limestone was produced from open quarries by H. E. Millard Lime & Stone Co., Swatara Station; Bethlehem Quarry Co., Steelton; and Hoffman Bros. and Wilson Inc., Elder Quarry, Swatara Township. In addition, H. E. Millard produced limestone from an underground mine. The limestone was crushed and sold for various uses, including flux, road material, and agricultural purposes.

H. E. Millard Lime & Stone Co. also operated a lime plant at Swatara Station.

Highspire Sand & Gravel Co., Ltd., Harrisburg, excavated sand and gravel from a wet pit and processed the material for paving use. Structural and paving gravel was also produced by the Pennsylvania Department of Highways in Dauphin County.

Miscellaneous clay was produced from open pits by Glen-Gery Shale Brick Corp. near Middletown and Bethlehem Quarry Co. near Steelton.

Producers of anthracite in 1954 were Dayton Coal Co., Howard Koppenhaven, Lykens Hi-Grade Coal Co., M & N Coal Co., Reilly Contracting Co., Spring Glen Coal Co., and Upper Dauphin Coal Co.

Delaware.—Granite, usable for building construction, was produced by Lima Building Stone Quarry, Inc. The General Crushed Stone Co. operated a quarry and crushing mill near Glen Mills and marketed crushed granite as road material. V. DiFrancesco & Sons produced basalt from the Devault and Llanerch quarries, Havertown, marketing the crushed basalt as railroad ballast and road material.

The Philadelphia Brick Co. produced miscellaneous clay from its open pit in Darby Township.

Sinclair Refining Co. produced brimstone as a byproduct in the liquid purification of gas at its Marcus Hook refinery.

Elk.—Near St. Marys, fire clay was produced from underground and open-pit mines by William J. Meyer, and miscellaneous clay was produced from an open pit by St. Marys Sewer Pipe Co. The fire clay was used in producing firebrick, while the miscellaneous clay was used in producing heavy clay products.

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Leading producers of bituminous coal in 1954 were Blue Valley Coal Co., Brandy Camp Coal Co., Ralph DeLullo, L. W. Gallagher, Peter Micale Estate, New Shawmut Mining Co., P & N Coal Co., Perry & Van Slander, Wabash Ridge Corp., and Walburn Coal Co. Bituminous coal was produced from both strip and underground mines. A small quantity of sulfur mud was produced in 1954.

Erie.—Bank-run sand was mined and processed by Nickel Plate Sand & Gravel Co., Fairview, and Wagner Concrete Building Products, Fairview Township, while Peerless Mineral Products Co. produced bank-run sand. Sand and gravel was dredged from a lake in Girard Township by North Girard Concrete Works. Kelley Island Lime Transport Co. produced structural sand and engine sand. The Pennsylvania Department of Highways produced gravel in 1954 for use in road construction. Mines were worked for peat.

Fayette.—Sand, for use as glass, molding, and furnace sand, was produced from an open pit by Dunbar Corp., Dunbar. McClain Sand Co., Inc., produced sand and gravel by dredging a river in Spring Hill Township and marketed the material for building purposes.

Flint fire clay was produced from open-pit mines by Robert N. Matthews, Uniontown; and Harbison-Walker Refractories Co. (formerly owned by the Union Fire Brick Co.) and Big Savage Refractories Corp., both of Ohiopyle. In addition, Big Savage Refractories Corp. produced plastic fire clay. Layton Fire Clay Co., Layton, operated an open-pit mine for producing miscellaneous clay for use in manufacturing heavy clay products.

General Refractories Co. produced sandstone from an underground mine near Childs for use in producing silica brick, while Connellsville Blue Stone Co. produced from a quarry near Connellsville for use as road material. Miscellaneous stone for building stone was produced by Lynns Quarry at Smithton, Pa.

Leading producers of bituminous coal in 1954 were Bridgeview Coal Co., Chellini Coal Co., Davidson-Connellsville Coal & Coke Co., Eastern Gas & Fuel Associates, Farm Coal Co., Latrobe Construction Co., Wm. Piccolomini Coal Co., Republic Steel Corp., the United States Steel Corp., and Weirton Coal Co. Bituminous coal was produced from both underground and strip mines.

Forest.—The Tionesta Sand & Gravel Co., Inc., operated a river dredge near Tionesta for producing sand and gravel. The Pennsylvania Department of Highways also produced gravel for paving purposes.

Franklin.—Six companies were active in 1954 for producing limestone. Limestone for use as road material was produced by Valley Quarries, Inc., Fry Coal & Stone Co., Binkley Bros., Inc., Baer & Martin, and Frank L. Heinbaugh. In addition Valley Quarries, Inc., and Fry Coal & Stone Co. prepared limestone for use as railroad ballast and for agricultural purposes respectively. Stewart & Gaston produced agricultural limestone at its plant. Sand for building purposes was mined, crushed, and screened by the Caledonia Sand Co. near Fayetteville. Sand also was produced by Mount Cydonia Sand Co.

Frank L. Heinbaugh, at a plant near Mercersburg, produced quicklime for use as agricultural lime.

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Fulton.—H. B. Mellott Estate, Inc., operated the Charleton quarry, Worfordsburg, and Morton quarry, Big Cove Tannery. The limestone for both quarries was crushed at the Big Cove Tannery crusher and sold as road material and for use in producing lime.

Oscar Martz operated a lime plant in Knobsville for the production of agricultural lime.

Rockhill Coal Co. was the only producer of bituminous coal in 1954, producing from a strip mine.

Greene.—Sandstone for use as road material was produced from an open quarry near Jefferson by C. Wilbur Acklin.

The only producer of clay in Greene County was Greene County Brick & Stone Co., producing miscellaneous clay from an open-pit mine near Waynesburg.

Leading producers of bituminous coal in 1954 in Greene County were the Buckeye Coal Co., Crucible Steel Co. of America, Duquesne Light Co., Emerald Coal & Coke Co., Jones & Laughlin Steel Corp., McCartney Coal Co., Molnar Bros. Coal Co., Mather Pickands & Co., Rosedale Coal Co., and the United States Steel Corp. The entire production of bituminous coal came from underground mines.

Huntingdon.—Ganister was produced by Harbison-Walker Refractories Co., Mount Union, and North American Refractories Co., Three Springs, for use in producing silica brick. Pennsylvania Glass Sand Corp., operating a quarry and crusher at Mapleton Depot, produced quartzite silica for use mainly as glass sand and abrasives. Limestone for road material was produced by New Enterprise Stone & Lime Co., McConnellstown; Warner Co., Tyrone (Union Furnace); and Tyrone Lime & Stone Co., Stover Quarry, Tyrone. Warner Co. also produced crushed limestone for use as railroad ballast, and Tyrone Lime & Stone Co. sold crushed limestone for agricultural purposes and as dusting material for coal mines.

Plastic fire clay was produced by Harbison-Walker Refractories Co. from an underground mine near Mount Union for use in manufacturing glass refractories. Alexandria Fire Clay Co. also produced plastic clay, but marketed the crude clay for use in manufacturing mortar.

Bank-run sand was processed by the Warrior Ridge Sand Co. at a site near the crest of Warrior Ridge.

Producers of bituminous coal in 1954 were Chamberlain Bros. Coal Co., Helm Coal Co., Ramper & Mort, Rockhill Coal Co., and Wrays Hill Coal Co. Bituminous coal was produced from both underground and strip mines.

Indiana.—Hiram Swank's Sons, Inc., produced plastic fire clay from an underground mine near Clymer for refractory use.

Smicksburg Lime, the only producer of stone in Indiana County, sold crushed limestone for agricultural purposes.

Leading producers of bituminous coal in 1954 were The Arcadia Co., Clearfield Bituminous Coal Corp., Crichton Coal & Coke Co., Heshbon Coal Co., Imperial Coal Corp., P & N Coal Co., Pennsylvania Electric Co., Pine Township Coal Co., Rochester & Pittsburgh Coal Co., and Westmoreland Mining Co. Bituminous coal was produced from both underground and strip mines.

Jefferson.—Plastic fire clay was produced from underground mines by Hanley Co., Summerville; Brockway Clay Co., Brockway;

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and Henry O'Neill & Co., Brookville. In addition, the Brockway Clay Co. operated an open-pit mine near Brockway to produce miscellaneous clay for manufacturing heavy clay products.

Leading producers of bituminous coal in 1954 were Armagost & Moore Coal Co., DuBois Coal Mining Co., Kann & Gutsie Coal Co., Kniseley Coal Co., Krach & Gearhart Coal Co., Maple Hill Coal Co., Minns Coal Co., Northwestern Mining & Exchange Co., Pulford Coal Co., and W. Pershing Stahlman. Bituminous coal was produced from both underground and strip mines.

Juniata.—Ganister for use in manufacturing silica brick was produced by the National Refractories Co., Inc., near the Van Dyke plant, Thompsontown. Limestone was quarried by W. N. Quigley near Mifflintown and prepared at a local crushing plant for road-construction use. The J. E. Baker Co. also operated a quarry and crusher near Bainbridge for producing stone as road material.

Lackawanna.—Leading producers of anthracite in 1954 were John Booth, Inc., Burke Coal Co., DeAngelis Coal Co., Hudson Coal Co., Moffat Coal Co., Motley Coal Co., Northwest Coal Co., Old Forge Coal Co., Turnpike Coal Co., and Village Slope Coal Co. A quantity of sandstone as rubble was produced by the Pennsylvania Department of Highways.

Lancaster.—A total of 12 companies produced limestone in Lancaster County in 1954, of which 2 produced both dimension and crushed limestone and 10 produced only crushed limestone. Dimension limestone was produced by D. M. Stoltzfus & Son, Inc., from a quarry at Talmage and by J. C. Showalter near Blue Ball. Crushed limestone was produced by D. M. Stoltzfus & Son, Inc., from quarries near Talmage and Quarryville; Ivan M. Martin, Inc., Blue Ball; Binkley & Ober, Inc., East Petersburg; A. G. Kurtz & Son Estate, Denver; J. Miller Eshleman, Landisville; J. C. Showalter, Blue Ball; David M. Burkholder, Martindale; Heisey Bros., Rheems; Erbs Limestone Quarry, Lititz; the J. E. Baker Co., Bainbridge; Landis Stone Meal Co., Rheems; and L. F. Zook & Sons, Bareville. Limestone produced in Lancaster County was sold mainly for road construction and agricultural purposes.

Milton Grove Sand, Inc., Mount Joy, and Hempt Bros., Elizabethtown, mined and processed sand for use as paving material.

Whitaker Clay Co. produced plastic fire clay from an open-pit mine near Narvon and marketed the crude material for use in manufacturing refractories. Glen-Gery Shale Brick Corp. operated the Ephrata open-pit mine, and Lancaster Brick Co. operated the Lancaster open-pit mine to produce miscellaneous clay for use in manufacturing heavy clay products at the company local plants.

The Maxwell limekiln, operated by Amos K. Stoltzfus near Elverson, produced quicklime and hydrated lime for use as fertilizer. The J. E. Baker Co., operating the Billmeyer plant, produced dead-burned dolomite for use as refractory material.

Lawrence.—The cement industry of the county is based upon the abundance of exceptionally pure limestone. Bessemer Limestone & Cement Co. produced limestone for use in its Bessemer cement plant (wet process). Medusa Portland Cement Co. produced limestone for use at its Wampum plant, producing cement by the dry process.

The Hillsville plant operated by Michigan Limestone Division,

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United States Steel Corp., quarried and crushed limestone for use as flux, road material, and in the production of cement. Bessemer Limestone-Cement Co. operated a quarry and crusher to produce limestone usable as flux and road material and in producing cement. Limestone for use as flux, road material, dusting for coal mines, and agricultural purposes was produced by New Castle Lime & Stone Co. in Mahoning Township.

Mahoning Valley Sand Co., West Pittsburgh (Taylor Township), processed bank-run sand and gravel for sale as paving material. Superior Sand & Supply Co., Eastbrook (Hickory Township), mined and processed bank-run sand and gravel for use in manufacturing cement blocks and ready-mix concrete.

Miscellaneous clay was produced from open-pit mines by Metropolitan Brick, Inc., Bessemer; Fenati Brick Co., Inc., Hickory Township; and Keystone Sand & Gravel Co., New Castle. Metropolitan Brick, Inc. also produced fire clay.

Leading producers of bituminous coal in 1954 were Ambrosia Coal & Construction Co., Bessemer Limestone & Cement Co., Bowie Coal Co., Buckeye Coal Co., Colonial Gas Coal Co., Corry Excavating & Mining Co., Hickory Coal Co., Lake Erie Coal Co., Marshall Mining Co., and West Freedom Mining Co. Bituminous coal was produced from both underground and strip mines, but the greater part of production came from strip mines. Peat also was produced in Lawrence County in 1954.

Lebanon.—The Bethlehem Steel Co. operated the Cornwall mine in 1954—the only metal-producing mine in the State. The crude ore yielded iron, copper, gold, silver, cobalt, and pyrite.

A quarry and crusher were operated by North American Refractories Co. near Womelsdorf to produce ganister used in manufacturing silica brick. The rock was transferred by an aerial tram from the quarry to the brick plant. Limestone, as road material, was produced from a quarry near Annville by Becker Bros.; Fiala Crushed Stone Corp., Annville; Pennsylvania Aggregates Co., Cornwall; and Henry K. Smith, Palmyra. In addition to road material, H. E. Millard Lime & Stone Co. produced limestone at the Annville and Palmyra quarries for use as metallurgical flux, agricultural limestone, in the manufacture of lime and cement, and for miscellaneous uses. Calcite Quarry Corp. operated a quarry and crusher near Lebanon to produce crushed limestone usable as flux and road and foundry material and in manufacturing cements.

The Annville and Palmyra plants operated by H. E. Millard Lime & Stone Co. produced both quicklime and hydrated lime. The lime was marketed for various uses, principally for metallurgical use, agricultural purposes, water purification and softening, and mason lime.

Lehigh.—Four companies producing cement in Lehigh County in 1954 were: Coplay Cement Mfg. Co., Coplay; Giant Portland Cement Co., Egypt; Lehigh-Portland Cement Co., Ormrod and Fogelsville; and the Whitehall Cement Mfg. Co., Cementon. All four companies produced either cement rock or limestone as a raw material for use in their production of cement.

A quarry and crusher were operated near Ormrod by Lehigh Stone Co. for the production of limestone used as road material.

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The only producer of slate in 1954 in Lehigh County was Penn Big Bed Slate Co., Inc. The slate was processed into a diversity of commodities, including roofing, blackboards, structural and sanitary products, bulletin boards, aquarium slate, and electrical slate.

Luzerne.—Leading producers of anthracite in 1954 were Glen Alden Coal Co., Harry E. Coal Co., Hudson Coal Co., Jeddo-Highland Coal Co., Kehoe-Berge Coal Co., Knox Coal Co., Lehigh Valley Coal Co., Newport Excavating Co., No. 9 Coal Co., and Susquehanna Collieries Division of M. A. Hanna Co.

Dimension sandstone was produced by Coon Certified Concrete Co. at the North Mountain Quarry, Sweet Valley, and quantities of crushed sandstone were sold from this quarry for use as road material. The General Crushed Stone Co. operated an open quarry and plant at White Haven to produce crushed sandstone usable as railroad ballast and road material. Jersey Central Lines produced limestone in Luzerne County for use as railroad ballast.

Four companies produced both sand and gravel: Airport Sand & Gravel Co., West Wyoming; Frank S. Sgarlat Estate, Forty Fort; Honey Hole Sand & Stone Co., Butler Township; and Glendale Sand & Stone Co., Avoca. Cunfer Bros. was also active in 1954 near Drums but produced only sand.

The Hazleton Brick Co., Hazleton, Luzerne County, was the only producer of clay which was used at its local plant in manufacturing building brick. Peat mines were worked, and Luzerne County was the leading producer in 1954.

Lycoming.—J. A. Eck & Sons, Inc., and Lycoming Silica Sand Co., both at Montoursville, produced sand and gravel in 1954, mainly for structural and paving uses.

Flagstone was quarried by John T. Morgan at Slate Run. Lycoming Silica Sand Co. operated the Lime Buff quarry and plant near Muncy to produce crushed limestone usable as road material. Crushed limestone as road material and for agricultural purposes was produced by Pine Creek Lime & Stone Co., Jersey Shore, and limestone for agricultural purposes was produced by Kenneth E. Fromm near Muncy.

The Keystone Filler & Mfg. Co. operated a quarry near Muncy for producing tripoli. The company dried, crushed, and pulverized the material in a local mill for use as abrasive material. Penn Paint & Filler Co., Antes Fort, dried and ground rottenstone for use as an abrasive and filler material.

The Chippewa plant was operated by Muncy Lime Products, Inc., to produce quicklime for use in fertilizers.

Keystone Filler & Mfg. Co. produced miscellaneous clay for use in paints from an open-pit mine near Muncy.

Producers of bituminous coal in 1954 were O. R. Carson, Fisher & Smith, Kaznowski & Kaznowski, and Thomas Coal Co. Bituminous coal was produced from both underground and strip mines.

McKean.—Plastic fire clay was produced from open-pit mines by Mount Jewett Fire Clay Co., Mount Jewett, and Kaul Clay Products Co., Clermont. Miscellaneous clay was mined by Hanley Co., Lewis Run. Mount Jewett Fire Clay Co. was active until December, when fire destroyed the mill.

Molding sand was produced from an open pit by C. L. McGavern,

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Jr. The United States Forest Service produced a small quantity of gravel for its use in McKean County.

Bituminous coal was produced in 1954 from stripping operations by Bowland Contractors, Kaul Clay Products Co., and P & K, Inc.

Mercer.—Sand and gravel producers in 1954 were Seidle Sand & Gravel Co., Jefferson Township; Liberty Stone Products Co., West Middlesex; and Transfer Sand & Gravel, Transfer. This material was sold principally to the structural and paving industries. Gravel was also produced by the Pennsylvania Department of Highways in Mercer County.

The White Rock quarry near Greenville was operated by the White Rock Silica Sand Co. to produce sandstone, which was crushed at a local plant and marketed for use in silica brick, road material, and beach and golf-course sand and for filter and foundry use.

Leading producers of bituminous coal in 1954 were Bobo Coal Co., Bowie Coal Co., Buckeye Coal Co., Center Coal Co., Coyer Coal Co., Fisher Mining Co., Liberty Stone Products Co., Mercer Coal Co., Plotts & Boyd Coal Co., and Earl Reed Coal Co. Bituminous coal was produced from both underground and strip mines, mostly from stripping operations. A small quantity of peat also was produced in 1954.

Mifflin.—Quartzite was produced by Haws Refractories Co. at Hawstone for use by the company in manufacturing silica brick. Quartzite silica was produced by the Pennsylvania Glass & Sand Corp. for use as abrasives and engine, foundry and glass sand. Bethlehem Quarry Co. produced limestone at the Naginey quarry and crushed the stone at a local mill, mainly for use as flux and road material.

Sand was quarried and processed by the Miller Silica Sand Co. near Burnham, as building, molding, and engine sand. James R. Kline's Sons operated a dredge on the Juniata River near Lewistown and produced sand for use in building.

Hydrated lime for use in fertilizers and as a refractory material was produced by Lewistown Lime Co. at its Reedsville plant.

Monroe.—Limestone was quarried and crushed near Hamilton by Thomas P. Rogers Stone Co., Inc., for use as road material and in manufacturing cement.

Sand and gravel for use as building material was produced by Coolbaugh Sand & Stone, Inc., Goulds Borough, and Steward White & Son, Stroudsburg (Stroud Township).

Montgomery.—Irregular-shaped bluestone for facing buildings was produced by William Bambi & Sons at Norristown. Ganister was produced by Firestone Products Co. (Eagle Hill) and Irvin D. Bill (Collegeville). M & M Stone Co. produced sandstone at Souderton for use as road material. Marcolina Bros., Inc., produced granite for construction use from the Hillcrest quarry, Cheltenham Township. Basalt was produced by Montgomery Stone Co. and R. K. Kibblehouse. Montgomery Stone Co. produced both rough and dressed granite at Montgomeryville. R. K. Kibblehouse produced granite as road material from a quarry at Perkiomenville. Limestone was quarried by G. & W. H. Corson, Inc., Plymouth Meeting; Bethlehem Quarry Co., Bridgeport; and Valley Forge Cement Co., West Conshohocken. Valley Forge Cement Co. production was used in manufacturing cement, but the other two companies' production was used mainly as flux or building material. A. Manero & Sons produced

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mica schist at Edge Hill for use as building stone and refractory material.

Allentown Portland Cement Co. produced both air-entrained and non-air-entrained cement by the wet process at its West Conshohocken cement plant. Cement rock was also produced by this company as a raw material for cement.

Quicklime and hydrated lime, for use as mason's lime and agricultural lime, and dead-burned dolomite were produced by G. & W. H. Corson, Inc., at Plymouth Meeting.

Miscellaneous clay was produced from open-pit mines by Robinson Clay Products Co., Pottstown; Lansdale Brick Products Co., Lansdale; Norristown Brick Co., Norristown; and Keller-Whilldin Pottery Co., North Wales. The clay was used at company plants in manufacturing heavy clay products. The Keller-Whilldin Pottery Co., however, used the material in producing flowerpots.

Bank-run sand was processed for use as building sand by William Bambi & Sons near Norristown.

Magnesium carbonate and magnesium oxide were produced from dolomite by Philip Carey Manufacturing Co. and Keasbey & Mattison Co.

Montour.—Mausdale Quarry Co., Danville, and Narehood Bros., Milton, quarried and crushed limestone for use as road material.

Quicklime, usable as refractory material, was produced by Harry Tittle.

Sand was mined and processed by James M. Thomas near Danville for use by local construction companies.

Northampton.—In 1954 11 companies produced limestone in Northampton County. Bethlehem Steel Co. operated the Bethlehem Quarry and produced limestone for use as road material, railroad ballast, and stone sand and in asphalt products. The Trumbower Co., Inc., operated a quarry near Nazareth to produce limestone used as road material. The Jersey Central Lines Railroad produced limestone for railroad ballast. Penn-Dixie Cement Corp. (Nazareth and West Winfield), Hercules Cement Corp. (Stockertown), Keystone Portland Cement Co. (Bath), Lone Star Cement Corp. (Nazareth), Lehigh Portland Cement Co. (Sandts Eddy), Dragon Cement Co., Inc. (Northampton), and Alpha Portland Cement Co. (Martins Creek), quarried limestone for use in manufacturing cement.

Ten companies were active in producing cement in 1954 from Northampton County: Alpha Portland Cement Co., Martins Creek; Dragon Cement Co., Inc., Northampton; Hercules Cement Corp., Stockertown; Keystone Portland Cement Co., Bath; Lehigh Portland Cement Co., Sandts Eddy; Lone Star Cement Corp., Nazareth; National Portland Cement Co., Bethlehem; Nazareth Cement Co., Nazareth; Penn-Dixie Cement Corp. Plants Nos. 5 and 6, Bath; and Universal Atlas Cement Co., Northampton.

Fifteen companies produced slate in Northampton County. The 10 leading companies were Stephens-Jackson Co., Courtney Quarry, Pen Argyl; David Stoddard & Sons, Inc., West-Albion Quarry, Plainfield; Anthony Dally & Sons, Inc., Pen Argyl; Capitol Slate Co., Inc., East Bangor; Diamond Slate Co., Inc., Pen Argyl; Bangor Roofing Slate, Inc., Bangor; Parsons Bros. Slate Co., Pen Argyl;

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Albion Vein Slate Co., West-Albion Quarry, Plainfield (Township); Doney Slate, Pen Argyl; and American Bangor Slate Co., Inc., Bangor. The slate was sold for various uses, mainly as roofing, structural and sanitary products, blackboards and bulletin boards, and flagging stone.

Bank-run sand and gravel was mined and processed by the Portland Sand & Gravel Co., Upper Mount Bethel Township, and W. J. Lowe & Sons, Bangor, principally as building and paving material.

Northumberland.—Sandstone was produced by Susquehanna Quarry Co. at Dalmatia for use as road material and railroad ballast. Eugene Meckley quarried limestone near Herndon and sold the crushed material for road material and agricultural purposes.

Miscellaneous clay was produced by Glen-Gery Shale Brick Co. and Watsontown Brick Co., both of Watsontown, for use at company local plants for producing heavy clay products. Watsontown Mineral Products Co. also produced miscellaneous clay for use in manufacturing linoleum and oilcloth and phonograph records.

Agricultural lime was produced by Clyde Starook at Sunbury.

Wilson Sand Plant, Montandon, screened bank-run sand for use in building.

Leading producers of anthracite in 1954 were Capitol Coal Co., Diminick Coal Sales Co., D. & Z. Coal Co., Philadelphia & Reading Coal & Iron Co., Phoenix Contracting Co., Raven Run Coal Co., Rosini Coal Co., Steam Coals, Inc., Stevens Coal Co., and Susquehanna Collieries Division of M. A. Hanna Co.

Perry.—Binkley Bros., Inc., quarried limestone as road material near Newport.

Philadelphia.—The Liberty Corp. operated the dredge *Freedom* near Philadelphia on the Delaware River and sold the screened and washed sand and gravel for building use.

Hydrogen sulfide was recovered by the Atlantic Refining Co. as a byproduct in the liquid purification of gas.

Pike.—The Pennsylvania Department of Highways produced a small quantity of paving gravel in Pike County in 1954.

Potter.—Oswayo Flag Stone Co. quarried miscellaneous stone near Shinglehouse, Pleasant Valley Township, for use as building stone, flagging, and road material.

Schuylkill.—Harbison-Walker Refractories' Andreas plant produced quartzite for use in manufacturing silica brick. Production of limestone as road material at the Andreas Quarry Co. quarry decreased compared with 1953 because the quarry was idle part of the year.

The Refractory Sand Co., Inc., near Andreas (West Penn Township) mined and processed sand for use as paving material, fire or furnace sand, and engine sand. A small quantity of gravel also was produced at this operation.

Miscellaneous clay was produced by Auburn Brick Co. for use at its local plant in producing heavy clay products.

Leading producers of anthracite in 1954 were Gilberton Coal Co., Indian Head Coal Co., Lehigh Navigation Coal Co., Locust Creek Coal Co., Mammoth Coal Co., Philadelphia & Reading Coal & Iron Co., Phoenix Contracting Co., St. Clair Coal Co., Weston Coal Co., and Yudacufski Bros. Contracting Co.

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Snyder.—Limestone usable as road material and for agricultural purposes was quarried and crushed by the National Limestone Quarry at Middleburg.

Miscellaneous clay for use in manufacturing heavy clay products was produced from open-pit mines by Paxton Brick Co., Paxtonville, and Glen-Gery Shale Brick Corp., Beavertown.

Carton Comfort produced quicklime for agricultural purposes at Mount Pleasant Mills.

Somerset.—The Friedens Block Co., produced sandstone at Somerset for use in producing concrete blocks. Dimension limestone was produced by Keystone Lime Co. at Springs. A. C. Lottig produced limestone from an underground mine at Meyersdale for use in agriculture. Somerset Limestone Co., Inc., operated its open pit and crushing plant at Somerset to produce crushed limestone as road material.

Fire clay, for use in manufacturing heavy clay products, was mined from open pits by Otto Brick & Tile Works, Springs, and W. S. Compton Brick Co., Salisbury. General Refractories Co. and Hiram Swank's Sons, Inc., Hollsopple, produced fire clay from underground mines for use at local company plants for producing refractories.

Sand for building use was produced by Friedens Block Co., Somerset, and Robert D. Shaulis, Boswell. Boswell Sand Co. marketed its sand as paving material. In addition to sand, M. S. Mays & Son produced gravel for use in construction from a pit and fixed preparation plant near Berlin.

Leading producers of bituminous coal in 1954 were Acosta-Gray Co., Bird Coal Co., Coal Junction Coal Co., Croner, Inc., Dunlo Coal Co., Loyal Hanna Coal & Coke Co., W. A. Merrill Sons & Co., Reitz Coal Co., The Saxman Coal & Coke Co., and Shade Coal Mining Co. Bituminous coal was produced from both strip and underground mines.

Lime for agricultural purposes was produced by A. C. Lottig at Meyersdale.

Sullivan.—Anthracite was produced in 1954 by Bernice White Ash Coal Co., Bliss Coal Co., Mildred Coal Co., and Park Side Coal Co.

Susquehanna.—H. V. Hartley quarried sandstone at Lenoxville and marketed the sandstone as flagging stone. Susquehanna Crushed Stone Corp. operated a quarry and plant near Kingsley to produce crushed sandstone as road material.

Tioga.—Bituminous coal was produced from underground and strip mines by Gee & Locey, E. M. Hart & Son, Jones & Brague Mining Co., Martin & Lawson, and Tom Sterling Coal Co.

Union.—Limestone was quarried and crushed by Faylor Lime & Stone Co., Winfield, and sold as road material and for agricultural use. John L. Iddings produced crushed limestone at Mifflinburg for construction use.

Venango.—J. T. Eichholtz operated a pit near Coopertown (Jackson Township) to produce sand for paving use. Industrial Silica Corp. operated a pit and fixed preparation plant near Utica (Canal Township) to produce quartzite for use in steel molding sands. Dredging was carried on in the Allegheny River near Oil City by the Oil City Sand & Gravel Co. to produce sand and gravel usable in building

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and road material. A small quantity of gravel also was produced by the Pennsylvania Department of Highways.

Bituminous coal was produced from stripping operations in 1954 by Bowie Coal Co., Boyles Coal & Supply Co., W. G. Brown Coal Co., C & M Contracting Co., Hitchman Coal & Coke Co., Serge Coal Co., and Zuck Coal Co.

Warren.—Robert M. Schatzle operated a pit and fixed preparation plant near Warren to produce bank-run sand and gravel for use in building. General Concrete Products Corp. operated a dredge on Allegheny River to produce and process sand and gravel for building and paving use. The Pennsylvania Department of Highways produced gravel as road material in Warren County.

Washington.—Miscellaneous clay was produced from open pits by Westmoreland Clay Products Co. (Washington), Monongahela Clay Products Co. (Monongahela), and Donley Brick Co. (Washington), for use at local company plants in manufacturing heavy clay products.

Leading producers of bituminous coal from underground and strip mines in 1954 from Washington County were Bethlehem Mines Corp., Greensburg-Connellsville Coal & Coke Co., Harmon Creek Coal Co., Jones & Laughlin Steel Corp., Mathies Coal Co., National Steel Corp., Ontario Mining Co., Pittsburgh Coal Co., Republic Steel Corp., and United States Steel Corp.

Wayne.—Sand and gravel was produced by Wayne Concrete & Sand Works, Lake Ariel; Charles Caputo, Honesdale; and Willis R. Black, Lake Ariel. The sand and gravel was sold mainly as building and paving material. A small quantity of gravel for paving use was produced by the Pennsylvania Department of Highways.

Westmoreland.—J. C. Beumont, North Belle Vernon, produced both rubble and flagging sandstone; J. G. Robinson, Inc., quarried only flagging sandstone. Crushed sandstone was marketed by Latrobe Construction Co., Longbridge Quarry, Latrobe; and Eidemiller Enterprises, Inc., Greensburg.

Kingston Brick Co. operated an open-pit mine near Latrobe to produce plastic fire clay and miscellaneous clay for use at the company local brick plant and also for sale on the open market. Westmoreland Clay Products Co. operated an open-pit mine near Youngwood to produce miscellaneous clay for use in manufacturing heavy clay products at its South Greensburg plant.

Leading producers of bituminous coal in 1954 from underground and strip mines were Allegheny Pittsburgh Coal Co., Bowman Coal Co., Delmont Fuel Co., Jamison Coal & Coke Co., Marco Coal Co., Inc., Pine Run Coal Co., Pittsburgh Coal Co., Republic Steel Corp., Seanor Mining Co., and Westmoreland Coal Co.

Wyoming.—Sand and gravel pits were operated by Wyoming Sand & Stone Co. and East Falls Sand & Gravel Co., both in Falls Township. A small quantity of gravel for paving use was also produced in Wyoming County by the Pennsylvania Department of Highways.

York.—Limestone was quarried and crushed by Thomasville Stone & Lime Co. and Lincoln Stone, Inc., Thomasville; The J. E. Baker Co., Botts; and National Gypsum Co., Eli Z. Zinn, Inc., White Pig-

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ment Corp., York Stone & Supply Co., and Standard Concrete Products Co., Inc., all of York.

Medusa Portland Cement Co. produced clay and white cement at its York plant.

General Mining Associates operated an open-pit mine near Glenville for producing mica for use in paints, rubber, welding rods, and insulation.

Neuman Sand & Supply Co. mined and processed bank-run sand, principally for building and paving use. Funkhouser Co. operated its slate quarry near Delta. The slate was ground and sold as flour and granules.

Glen-Gery Shale Brick Co. produced miscellaneous clay from an open pit for use in manufacturing of heavy clay products at its York plant.

The York plant of National Gypsum Co. was active in 1954, producing both quicklime and hydrated lime. The lime was produced for various uses, principally the following: Fertilizers, insecticides, fungicides and disinfectants; water purification and softening; and paper.

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The Mineral Industry of the Commonwealth of Puerto Rico, the Panama Canal Zone, and the Virgin Islands

The Puerto Rico portion of chapter has been prepared under a cooperative agreement for the collection of mineral data except mineral fuels between the Bureau of Mines, United States Department of the Interior, and the Mineralogy and Geology Section, Commonwealth of Puerto Rico.

By W. G. Diamond[1] and Mort D. Turner[2]

PUERTO RICO

MINERAL production in Puerto Rico in 1954 was valued at $12.4 million, a 9-percent increase over 1953. Six minerals were produced: cement, stone, and sand and gravel accounted for 97 percent of the value, but significant quantities of lime, salt, and clays were also produced.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

TRENDS AND DEVELOPMENTS

Construction was begun on a 10,000-barrel-per-day petroleum refinery in the Bayamon industrial area north of San Juan. The refinery will be built by Caribbean Refining Co. at an estimated cost of $11 million. Eastern Venezuelan crude will be processed and most of the products will be marketed in the San Juan area. Facilities include fluid catalytic cracking, catalytic polymerization, gas recovery, and atmospheric and vacuum distillation units. Completion is scheduled for early 1955.[3]

Commonwealth Oil Refining Co., Inc., began construction on a large refinery at Guayanilla Bay, 15 miles west of Ponce. The new refinery is scheduled for completion in 1955 and will process about 25,000 barrels daily of Venezuelan crudes.[4]

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[1] Commodity-industry economist, Region IV, Bureau of Mines, Bartlesville, Okla.
[2] Chief geologist, Mineralogy and Geology Section, Commonwealth of Puerto Rico.
[3] Oil and Gas Journal, vol. 52, No. 41, Feb. 15, 1954, pp. 111, 114.
[4] Petroleum Engineer, vol. 26, No. 9, August, 1954, p. C-65.

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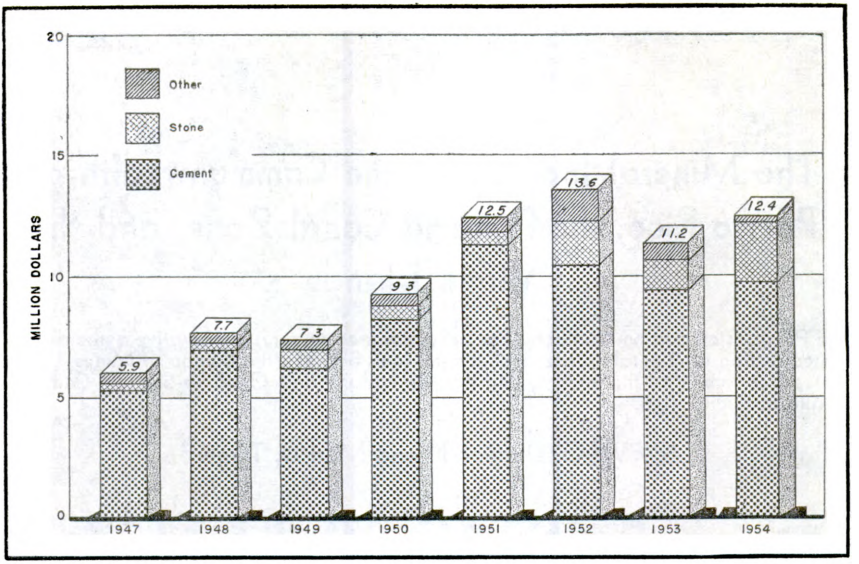

FIGURE 1.—Total value of mineral production in Puerto Rico, 1947–54.

TABLE 1.—Mineral production in possessions of the United States, 1953–54, by individual minerals [1]

Possession and mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Canal Zone:				
Sand and gravel	85,914	$95.500		
Stone (crushed)	171,908	231,752	187,446	$245,170
Total Canal Zone		327,252		245,170
Puerto Rico:				
Cement—376-pound barrels	3,641,135	9,335,421	3,682,187	9,663,445
Iron ore (usable)—long tons	[2] 42,643	[2] 245,000		
Lime (open market)	7,338	157,467	8,384	198,452
Salt (common)	13,692	131,490	8,758	98,110
Sand and gravel	226,586	250,202	374,690	833,654
Stone	[3] [4] 648,400	[3] [4] 1,237,236	[2] [3] 1,751,996	[2] [3] 2,492,827
Undistributed: Other nonmetallic minerals		44,466		154,331
Total Puerto Rico		11,401,000		[5] 12,381,000
Virgin Islands: Stone (crushed)	10,789	45,853	3,939	17,134
Grand total		11,774,000		[5] 12,643,000

[1] Production as measured by mine shipments or mine sales (including consumption by producers).
[2] Final figures. Supersedes preliminary figure given in commodity chapter.
[3] Excludes certain stone, value for which is included with "Undistributed."
[4] Excludes limestone for cement and lime.
[5] The total has been adjusted to eliminate duplication in value of clays and stone.

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VALUES

The values of mineral production shown in the tables are those reported at the mine or plant. Table 2 shows the average values of all commodities produced in the Canal Zone, Puerto Rico, and the Virgin Islands, 1950–54. Limestone used in manufacturing cement and lime was added to the stone tabulation for the first time in 1954—hence the reduction in average unit value.

TABLE 2.—Average unit values of mineral commodities in the Canal Zone, Puerto Rico, and the Virgin Islands [1]

Area and commodity	1950	1951	1952	1953	1954
Canal Zone:					
Basalt, crushed and broken.....short ton..	$1.57	$2.02	$1.77	$1.35	$1.31
Sand and gravel.....do....	.68	.81	.94	1.11	.....
Puerto Rico:					
Cement.....376-pound barrel..	2.60	2.62	2.63	2.56	2.62
Iron ore.....long ton..	.....	5.74	5.75	5.75	.....
Lime.....short ton..	22.14	18.49	22.74	21.46	23.67
Salt.....do....	10.13	11.29	9.64	9.60	11.20
Sand.....do....	.97	.53	1.21	1.05	1.07
Gravel.....do....	1.04	1.30	1.81	1.13	2.53
Stone:					
Basalt.....do....	1.24	1.47	1.55	.....	.....
Granite, crushed and broken.....do....	1.00	1.00	1.00	1.00	.....
Limestone:					
Crushed and broken.....do....	2.42	2.13	2.74	1.90	[2] 1.37
Dimension.....do....	[3]	4.85	1.60	2.04	2.12
Sandstone, crushed and broken.....do....	.....	.....	.....	.....	2.13
Miscellaneous stone:					
Crushed and broken.....do....	.....	.....	2.33	1.70	2.42
Dimension.....do....	.....	.....	.....	.....	1.09
Virgin Islands: Stone, miscellaneous, crushed and broken.....short ton..	1.57	4.08	4.02	4.25	4.35

[1] For greater detail on prices, by grades and markets, see vol. I, Minerals Yearbook, 1954.
[2] Includes limestone used for cement and lime.
[3] Data not available.

REVIEW BY MINERAL COMMODITIES

Cement.—Cement was the most important commodity produced in Puerto Rico in 1954, composing 78 percent of the total value of mineral output. Shipments of portland cement increased 1 percent in quantity and 4 percent in value over 1953. During this period the Puerto Rico Asbestos Cement Products Corp. of Ponce began to produce flat and corrugated asbestos-cement sheeting, using imported asbestos and local cement, lime, and sand.

Clay.—The production of miscellaneous clay in 1954 increased slightly over 1953; the output was used for heavy clay products. Puerto Rico Clay Products Corp. in Carolina initiated the production of glazed and unglazed pipe and heat insulation tile, in addition to its regular hollow structural tile and other heavy clay products. In the same locality, the Joo Italian Ceramic Corp. manufactured decorated wall tile.

Lime.—The 1954 output of lime increased 14 percent in quantity and 26 percent in value over 1953. Planta de Cal "Hicaco," Inc., is the main source of lime for the raw-sugar industry of Puerto Rico. Limestone for this pure lime is quarried in the form of calcareous sand from Cayo Hicaco of the northeast coast of Puerto Rico. Lime was produced in the Districts of Humacao and Mayaguez.

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TABLE 3.—Portland-cement shipments from mills in Puerto Rico, 1939–54

Year	376-pound barrels	Value	Year	376-pound barrels	Value
1939–49	13,501,577	$33,411,741	1953	3,641,135	$9,335,421
1950	3,187,451	8,299,186	1954	3,682,187	9,663,445
1951	4,297,583	11,252,350			
1952	3,994,483	10,517,894	Total	[1] 32,304,416	[1] 82,480,037

[1] Total cement shipments to date.

Salt.—Salt was produced in Mayaguez District by the evaporation of sea water. The total quantity sold or used in 1954 decreased 36 percent and total value 25 percent from 1953.

Sand and Gravel.—New records for the tonnage and value of sand and gravel in Puerto Rico were established in 1954, when nearly 375,000 tons valued at almost $834,000 was produced. The new totals surpassed the records set in 1953 by 65 percent in quantity and over 200 percent in value. An appreciable portion of the sand produced was a very high silica sand used in bottle glass and ceramic products. Numerous small concrete-block plants accelerated operations throughout the island in 1954. Although each plant employs only 2 or 3 men, the overall production is becoming more and more important to the construction industry of Puerto Rico.

Stone.—The production of stone in 1954, including that used for cement and lime, increased 170 percent in quantity and 101 percent in value over 1953. Limestone used for cement and lime was included in the stone totals for the first time in 1954. Stone production in 1954 (excluding that used for cement and lime) increased 29 percent in quantity and 27 percent in value over 1953. Crushed limestone was produced in each of the seven districts. Dimension limestone was quarried in Guayama, Mayaguez, San Juan, Humacao, and Ponce Districts. Crushed sandstone was produced in Mayaguez District. Crushed and dimension miscellaneous stone was quarried in San Juan District. During 1954 the use of dimension stone became very popular in home construction for facing and walls, and production was expanded to meet the demand.

TABLE 4.—Stone sold or used by producers in Puerto Rico, 1950–54

Year	Dimension limestone		Crushed limestone		Other stone [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1950	[2]	[2]	227,430	$551,389	22,580	$23,320	[3] 250,010	[3] $574,709
1951	13,377	$64,913	244,844	521,048	25,476	27,790	283,697	613,751
1952	13,684	21,866	605,830	1,659,910	69,806	125,612	[3] 689,320	[3] 1,807,388
1953	16,552	33,733	631,848	1,203,503	[2]	[2]	[3] 648,400	[3] 1,237,236
1954	99,889	211,476	[4] 1,639,684	[4] 2,252,812	12,423	28,539	[3] [4] 1,751,996	[3] [4] 2,492,827

[1] Includes basalt, granite, sandstone, miscellaneous stone.
[2] Figure withheld to avoid disclosing individual company operations.
[3] Excludes dimension limestone (1950); crushed basalt (1952); crushed granite and miscellaneous stone (1953); and crushed sandstone (1954).
[4] Includes limestone for cement and lime.

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Metals.—No metal ore was mined in Puerto Rico in 1954. Deposits of manganese, iron, nickel, cobalt, and chromium were investigated by the Commonwealth Government, the Federal Government, and private companies.

REVIEW BY DISTRICTS

Aguadilla.—Limestone was quarried and crushed for concrete aggregate and road metal by Antilles Area Office, General Builders & Suppliers, Antonio Santos, Luis Viera, and department of public works; and for use as undressed dimension stone by Victoria Medina. Building and paving sand was produced by F. J. Rosello, General Builders & Suppliers, and Aguadilla Department of Public Works. Army Corps of Engineers produced paving gravel. Aguadilla District was the leading producer of stone and sand and gravel.

Arecibo.—Severo O'Neil and Arecibo Department of Public Works produced crushed limestone, which was used for concrete and road metal purposes. The department of public works also produced paving sand and gravel.

Guayama.—Dimension limestone was quarried and used for rough construction purposes by Cantera Sanchez, Inc. Francisco Navarro and Guayama Department of Public Works quarried and crushed limestone for concrete and road metal. Sand and gravel for structural purposes was obtained from deposits in Guayama District by Jose A. Lopez and Planta del Turabo. The department of public works produced paving sand.

TABLE 5.—Value of mineral production in Puerto Rico by Districts, 1953–54

District	1953	1954	Minerals produced in 1954 in order of value
Aguadilla	$607,081	$1,218,727	Stone, sand and gravel.
Arecibo	59,760	53,926	Do.
Guayama	107,954	142,860	Do.
Humacao	160,343	185,068	Lime, stone, sand and gravel.
Mayaguez	280,058	405,583	Stone, salt, lime, sand and gravel.
Ponce	5,219,913	5,442,261	Cement, sand and gravel, stone.
San Juan	4,720,273	4,923,323	Cement, stone, sand and gravel, clay.
Undistributed	245,000	9,482	Sand and gravel.
Total	11,401,000	12,381,000	

Humacao.—Planta de Cal "Hicaco", Inc., produced lime in Humacao District. Quantity and value of lime sold or used increased over 1953. Crushed limestone was produced by Fajardo Sugar Co. (for concrete, road metal, and railroad ballast), by Planta de Cal "Hicaco," Inc. (for agricultural stone and whiting), and by Ramon Rivera Figueroa (for concrete and road metal). Mateo Perez Sanjurio quarried dimension limestone for rough construction. Marcial Solfs obtained structural gravel from deposits in Humacao District.

Mayaguez.—Limestone was quarried and crushed for concrete and road metal by Waldemar Bravo, Ovidio Marty Pabon, Eugenio Natali, department of public works, and Jose A. Vallejo. The South Puerto Rico Sugar Co. quarried and crushed limestone from its Guanica quarry for use as concrete and road metal, railroad ballast,

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and sugar refining, with a small quantity of dimension stone used as rubble. Dimension limestone was quarried by Cantera Bernat for rough construction and by Liborio Lopez Sanchez for rubble. Liborio Lopez Sanchez also produced crushed sandstone for concrete and road metal. Salt was produced from sea water by Carlos M. Ramirez Acosta at Salina Fortuna; Puerto Rico Salt Works, Inc., at Boqueron, Providence, and Cabo Rojo; and Salinas del Papayo, Inc. Cantera Bernat produced structural gravel and Liborio Lopez Sanchez produced paving gravel.

Ponce.—The Ponce Cement Corp. operated the Ponce mill throughout the year. Total shipments and value of shipments of portland cement increased over 1953. Ismael Torruellas and department of public works produced paving sand and gravel, and Ponce Aggregates Co. and Amparo Ortiz produced building and paving gravel. Limestone was quarried and crushed for concrete and road metal by Ismael Torruellas, Francisco Semidey, Antonio Padilla, and Ponce Department of Public Works. Dimension limestone was quarried for use as rubble by Ismael Torruellas.

San Juan.—The Puerto Rico Cement Corp. produced portland cement at its Guanabo mill in San Juan District. Crushed limestone was produced and used mainly as concrete and road metal. Producers included San Juan Department of Public Works, Ramos Hermanos, Inc., J. Ortiz Toro, Cantanen Hnos, Compania de Ing. & Contratistas, Ramon Lopez Rodriquez, and Severo O'Neil. Ramon Lopez Rodriguez produced dimension limestone for rough construction and rubble building stone. Glass sand was produced by Puerto Rico Glass Corp. and paving sand and gravel by San Juan Department of Public Works. Puerto Rico Clay Products, Inc., obtained shale from deposits in San Juan District for use in manufacturing heavy clay products.

PANAMA CANAL ZONE

The production of stone was reported in the Panama Canal Zone in 1954 and was the only mineral commodity produced. Total value of mineral production in 1954 was less than 1953 production, owing to the fact that no sand and gravel was produced in 1954.

REVIEW BY MINERAL COMMODITIES

Basalt.—Basalt was quarried and crushed for concrete, road metal, and riprap purposes by the Panama Canal Co. and the United States Army—Caribbean. The production of basalt increased 9 percent in quantity and 6 percent in value over 1953.

TABLE 6.—Crushed basalt sold or used by producers in the Canal Zone, 1947–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1947–49 (average)	129,733	$194,600	1952	86,000	$152,000
1950	53,000	83,000	1953	171,908	231,752
1951	55,500	112,000	1954	187,446	245,170

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TABLE 7.—Sand and gravel sold or used by producers in the Canal Zone, 1947–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1947–49 (average)	46,267	$69,400	1952	56,600	$53,000
1950	22,000	15,000	1953	85,914	95,500
1951	32,000	26,000	1954		

VIRGIN ISLANDS

Stone was produced in the Virgin Islands in 1954. Total 1954 production was 3,939 tons valued at $17,134, a decrease of 63 percent in quantity and value from 1953.

REVIEW BY MINERAL COMMODITIES

Basalt.—The Virgin Islands Corp. quarried and crushed basalt on St. Croix Island, used mainly for concrete and road metal.

TABLE 8.—Crushed miscellaneous stone sold or used by producers in St. Croix Island, Virgin Islands, 1948–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1948–49 (average)	9,150	$15,000	1952	3,800	$16,150
1950	2,540	4,000	1953	10,789	45,853
1951	5,700	24,200	1954	[1] 3,939	17,134

[1] All basalt.

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The Mineral Industry of Rhode Island

By Alvin Kaufman [1] and C. Geraldine Cleary [2]

RHODE ISLAND'S mineral production remained virtually the same in 1954 as in 1953. Some production data for 1954 were collected jointly with the Bureau of the Census (U. S. Department of Commerce). Production totals will be compared with the Census totals when they are available, and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage. Sand and gravel, which in value comprised 67 percent of the total Rhode Island mineral output, continued to be the major mineral commodity. Stone was the second most important commodity in value; graphite ranked third. Providence County was the major mineral-producing area in Rhode Island. Kent, Washington, and Newport Counties followed in that order. There was no mineral production in Bristol County.

TABLE 1.—Value of mineral production 1953–54, by counties [1] [2]

County	1953	1954	Minerals produced in 1954 in order of value
Kent and Newport	$229,308	$386,736	Sand and gravel, stone.
Providence	931,945	766,760	Sand and gravel, stone, graphite.
Washington	300,543	307,160	Stone, sand and gravel.
Total	1,462,000	1,461,000	

[1] Production as measured by mine shipments and mine sales (including consumption by producers).
[2] Production was not reported for Bristol County.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Graphite.—Graphite Mines, Inc., continued to produce natural amorphous graphite from a former meta-anthracite coal mine for use in preparing foundry facings and paint pigments.

Sand and Gravel.—Sand and gravel output, mostly for building and paving purposes, gained 13 percent over the previous year. The number of operations reporting to the Bureau of Mines increased from 10 in 1953 to 17 in 1954, pits produced in Kent, Newport, Providence, and Washington Counties. Major producers were Rhode Island Sand & Gravel Co., Inc., Kent County; M. A. Gammino Construction Co., and A. Cardi Sand Co., both in Providence.

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[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.
[2] Statistical clerk, Region V, Bureau of Mines, Pittsburgh, Pa.

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Stone.—Production of granite, limestone, and miscellaneous stone declined 35 percent in 1954 compared with 1953. Quarries were active in Newport, Providence, and Washington Counties. No basalt output was reported to the Bureau of Mines in 1954. Producers in Providence County were responsible for 58 percent of the total value of stone produced in Rhode Island in 1954.

REVIEW BY COUNTIES

Kent.—Sand and gravel for structural, paving, fire, and miscellaneous uses was produced in Kent County in 1954 by Rhode Island Sand & Gravel Co., Inc., Hillsgrove; Luigi Vallone, Inc., Warwick; Barber Sand & Gravel Co., Coventry; and Whitehead Bros. Co., Washington. Barber Sand & Gravel Co. began operating a fixed preparation plant on April 1, 1954.

Newport.—Peckham Bros. Co. worked a conglomerate quarry in 1954. This material was crushed in the company mill and sold as concrete aggregate and road material. Callan Construction Corp. operated a gravel crushing and screening plant near Portsmouth.

Providence.—Sand and gravel, stone, and graphite were produced in Providence County in 1954. The mines and quarries of Providence County supplied 52 percent of the total value or Rhode Island's mineral output. Sand and gravel, the major mineral commodity, was produced by A. Cardi Construction Co. and Del Bonis Sand & Gravel Co., Inc., both near Oaklawn; Tasca Sand & Gravel Co., Smithfield; Town Line Sand & Gravel Co., Slatersville; and Valley Cement Block Co., Providence. Providence County was the only area in Rhode Island in which limestone was produced. A quarry near Saylesville, operated by the Conklin Limestone Co., Inc., yielded agricultural stone. Crushed granite for concrete aggregate and road material was produced by Fanning & Doorley Construction Co., Berkeley. This plant only operated during part of the year. It was anticipated that it would be reopened in April 1955.

Washington.—The major mineral industry in Washington County was the production of stone, output of which consisted of irregular-shaped monumental granite. Smith Granite Works and Sullivan Granite Co., both with quarries near Westerly, were the only producers of this material. Sullivan Granite Co. also produced a small quantity of riprap and crushed stone for miscellaneous uses. Sand and gravel principally for paving and structural purposes, was produced by Frank J. Olivo, Narragansett; J. Romanella & Sons, Westerly; Louis B. Schaeffer, Peace Dale; South County Sand & Gravel Co., Peace Dale; and Elisha Taylor, West Kingston.

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The Mineral Industry of South Carolina

This chapter has been prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, United States Department of the Interior, and the Geological Survey of South Carolina.

By Avery H. Reed, Jr.[1] and Laurence L. Smith [2]

THE YEAR 1954 saw little change in the total value of mineral output in South Carolina. Some production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage. Small decreases in most commodities were not compensated by increases in others; as a result, the total value of mineral production in 1954 fell $27,000 below that in 1953. Structural materials, including clay, sand and gravel, crushed stone, and portland cement, representing 92 percent of the State's mineral production, made a combined net gain of 2 percent in value. Of the minor commodities, small losses in both tonnage and value were reported for barite and kyanite; vermiculite increased in both tonnage and value, but dimension stone, though increasing in tonnage, dropped sharply in value.

TABLE 1.—Mineral production in South Carolina, 1953–54 [1]

Mineral	1953		1954	
	Short tons	Value	Short tons	Value
Clays	964,356	$4,801,921	1,136,019	$4,702,027
Sand and gravel	2,975,608	2,564,484	2,813,750	2,550,260
Stone, crushed	2,913,860	3,976,370	2,861,953	4,233,270
Undistributed: Barite, cement, kyanite, mica (1954), stone, dimension granite, and vermiculite		[2] 6,428,135		6,373,880
Total South Carolina		17,771,000		[2] 17,744,000

[1] Production as measured by mine or plant shipments, sales, or marketable production (including consumption by producers.)
[2] Adjusted to eliminate duplication in the value of raw materials used in manufacturing cement.

A welcome addition in 1954 was the recording of new production of both sheet and scrap mica. Although these figures cannot be divulged because of exposing individual plant production, there were 4 producers of sheet mica and 1 of scrap mica, making a small addition to the value of South Carolina's mineral production.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Knoxville, Tenn.
[2] State geologist, South Carolina Geological Survey, Columbia, S. C.

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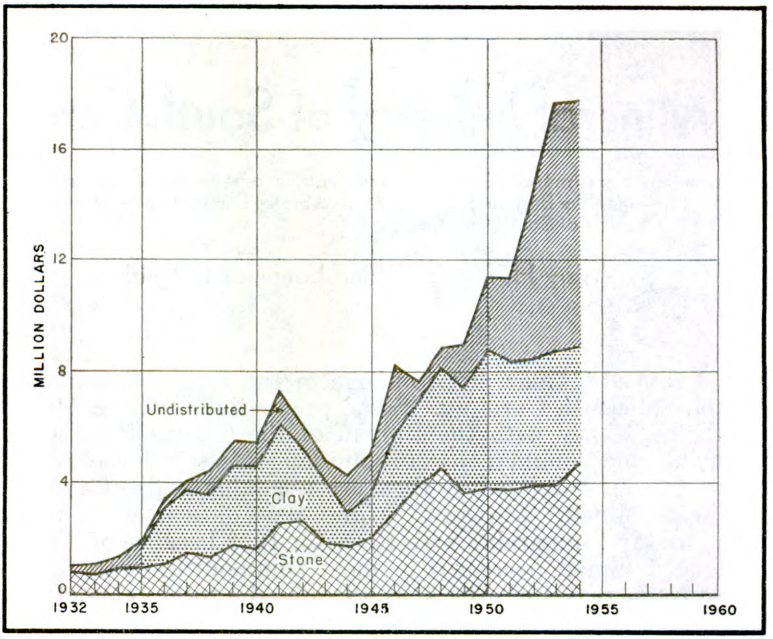

FIGURE 1.—Total value of mineral production of South Carolina, 1932–54.

TABLE 2.—Average unit value of mineral commodities produced in South Carolina, 1950–54 [1]

Commodity	1950	1951	1952	1953	1954
Crude barite short ton	$7.25	$7.28	$7.00	$6.00	$6.00
Cement 376-pound barrel	2.56	2.77	2.75	2.80	2.82
Clays:					
Fire short ton	1.63	2.61	2.42	2.90	
Kaolin do	12.91	12.71	12.64	12.87	12.93
Miscellaneous do	.80	1.00	.93	.84	.88
Cement (estimate) do	.75	1.00	1.00	1.00	1.00
Kyanite do	32.76	37.00	40.00	40.00	38.25
Gravel do	.34	.45	.70	1.16	1.30
Sand do	.51	.43	.86	.57	.61
Vermiculite do	10.00	12.82	12.57	13.08	13.05
Stone:					
Granite (dimension) cubic foot	2.78	3.25	3.25	3.25	1.76
Granite (crushed) short ton	1.30	1.28	1.31	1.35	1.37
Limestone (crushed) do	1.50	1.49	1.59	1.54	2.00
Miscellaneous stone (crushed) do	.60	.65	.65		

[1] For greater detail on prices and markets, see vol. I, Minerals Yearbook, 1954.

REVIEW BY MINERAL COMMODITIES

METALS

There was no reported production of metals or metallic ores from the State in 1954.

Monazite.—As a result of successful exploration for monazite by the Callahan Zinc-Lead Co., in cooperation with the Defense Minerals Exploration Administration (DMEA), the company made plans for early production by dredging.

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NONMETALS

Barite.—Barite production decreased 6 percent in tonnage and 7 percent in value below 1953.

Clays.—Clay production, including that mined and used in manufacturing cement, increased 18 percent in tonnage but declined 2 percent in total value below that in 1953. The reason for this anomaly was the decreased production of the higher priced kaolins and the increased production of the lower priced miscellaneous clays.

In 1954 no fire clay was reported as such, but a small tonnage of refractory clay was included in both kaolin and miscellaneous clays.

Kaolin production declined 6 percent in tonnage and value below 1953. The Bell Kaolin Co., Batesburg, S. C., known in Tennessee as the Bell Clay Co., opened a new clay deposit at Batesburg.

Miscellaneous clays, on the other hand, increased 33 percent in tonnage and 34 percent in value above 1953.

The Broad River Brick Co., Gaffney, S. C., during the year completely razed its old kiln plant, and its own employees constructed a new tunnel-kiln plant of 50,000-brick daily capacity. Production in the new plant began in August.[3]

TABLE 3.—Clays sold or used by producers, 1945–49 (average) and 1950–54, by kinds

Year	Fire clay		Kaolin		Miscellaneous clay		Total [1]	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	(2)	(2)	251,713	$2,714,007	(2)	(2)	(2)	(2)
1950	(2)	(2)	348,948	4,505,022	638,852	$508,223	987,800	$5,013,245
1951	(2)	(2)	322,208	4,095,912	619,272	620,022	941,480	4,715,934
1952	7,547	$18,250	322,778	4,079,112	616,953	577,899	947,278	4,675,261
1953	15,208	44,075	327,594	4,213,431	621,554	544,415	964,356	4,801,921
1954			307,953	3,974,367	828,066	727,660	1,136,019	4,702,027

[1] Excludes fire clay, 1949–51.
[2] Data not available.
[3] Figure withheld to avoid disclosure of individual company operations.

Kyanite.—Production of kyanite decreased roughly 35 percent in tonnage and value below 1953.

Mica.—For the first time since 1946, 4 producers from 3 counties reported mica production. Neither the total tonnage nor value produced may be disclosed without divulging individual company production.

[3] Brick and Clay Record, August 1954, p. 30.

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Sand and Gravel.—The production of sand and gravel for sale or use by producers in South Carolina in 1954 declined 5 percent in volume and 1 percent in value below 1953. A number of producers reported for the first time. In all, 24 operators reported commercial production from 15 counties. Noncommercial (Government-and-contractor) production was reported from 2 producers from 14 counties; tonnage was reported without county credit.

In 1954 production of sand and gravel was composed roughly of 1.5 million short tons of commercial sand valued at just under $1 million, 40,000 short tons of noncommercial sand valued at $8,000, and 1.25 million short tons of commercial gravel valued at $1.6 million.

The average days worked annually by the reporting plants was 270, and the tons produced per man-day was 35.5, with average tons per man-hour calculated at 4.2.

TABLE 4.—Sand and gravel sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	427,182	$207,780	1952	1,048,099	$892,312
1950	348,060	166,710	1953	2,975,608	2,564,484
1951	320,195	139,258	1954	2,813,750	2,550,260

Stone.—Crushed granite for riprap, concrete and road construction, railroad ballast, and other uses again composed over 90 percent of the State stone production. Crushed granite sold or used by producers increased 6 percent in tonnage and 8 percent in value above 1953. The average value a ton increased 2 cents. Granite used for dimension stone increased appreciably in tonnage but decreased in value below 1953.

All limestone quarried in the State in 1954, except that used in manufacturing cement, was crushed and used for agricultural purposes. Total production dropped to only 15 percent of 1953 owing to closing of the Cherokee County quarry of the Campbell Limestone Co.

Mica schist crushed and ground for use as various fillers became a substantial new market product.

TABLE 5.—Stone sold or used by producers, 1945–49 (average) and 1950–54

Year	Dimension granite		Crushed granite		Crushed limestone		Miscellaneous stone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945–49(ave.)	25,018	$790,164	1,791,272	$2,252,765	(1)	(1)	(1)	(1)	[2] 2,090,440	[2] $3,425,075
1950	14,156	477,291	2,223,923	2,891,109	319,431	$477,656	(1)	(1)	2,557,510	3,836,056
1951	(1)	(1)	2,528,473	3,242,140	300,150	447,815	245	$159	[2] 2,828,868	[2] 3,690,114
1952	(1)	(1)	2,648,284	3,456,684	266,095	424,195	460	299	[2] 2,914,839	[2] 3,881,178
1953	(1)	(1)	2,660,989	3,587,827	252,871	388,543	------	------	[2] 2,913,860	[2] 3,976,370
1954	(1)	(1)	[2] 2,812,196	[3] 3,863,270	38,000	76,000	(1)	(1)	[2] [3] 2,861,953	[2] [3] 4,233,270

[1] Figure withheld to avoid disclosure of individual company operations.
[2] Incomplete figure; excludes certain stone indicated by footnote 1.
[3] Revised figure.

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Vermiculite.—Four producers supplied the vermiculite production in South Carolina in 1954. Tonnage increased 11 percent and total value 10 percent above 1953. The National Vermiculite Co. permanently closed its mine in Laurens County.

REVIEW BY COUNTIES

Aiken.—Aiken County ranked second in value of mineral products in 1954. The DMEA monazite-exploration project, by the Callahan Zinc-Lead Co., was concluded, and the company began planning a dredging operation. Production of kaolin was reported by the same operators as in 1953—The J. M. Huber Corp., from its Ideal, Paragon, and Barden mines; the National Kaolin Products. Co., from its Aiken mine; the Southeastern Clay Co., from its Flock, Johnson, Rodgers, and Toole mines; the Dixie Clay Co., from its McNamee mine; and, in addition, the Bell Kaolin Co. Production and value declined 6 percent below 1953. Miscellaneous clays for brick and heavy clay products were mined by the Georgia-Carolina Brick Co. but at only about 80 percent of the 1953 rate.

TABLE 6.—Clays sold or used by producers in Aiken County, 1949–54

Year	Short tons	Value	Year	Short tons	Value
1949	295,906	$3,487,813	1952	349,212	$4,062,248
1950	373,794	4,491,157	1953	367,087	4,248,976
1951	349,708	4,100,912	1954	339,490	4,000,576

The Carolina Aggregates Co. and the Augusta Sand & Gravel Co. reported production of structural and paving sand and gravel, and the State highway department reported furnishing 1,120 short tons of paving sand.

Anderson.—Frank Holland and Fred Wilson both reported mining several pounds of sheet mica. The State highway department obtained 7,095 short tons of paving sand for local roads.

Bamberg.—The Colleton Sand & Silica Co. reported a substantial tonnage of building sand.

Calhoun.—The State highway department mined 200 tons of paving sand for local use.

Charleston.—The Edisto Sand & Gravel Co. mined sand for the building trade, and the Sandrying Co. supplied material for silica filler.

Cherokee.—Barite mined by Industrial Minerals, Inc., declined 6 percent in tonnage and 7 percent in value below 1953. The Broad River Brick Co. mined roughly 6,000 short tons of miscellaneous clays for use in manufacturing brick and heavy clay products.

The State highway department mined 500 short tons of paving sand for local roads. The Jobe Sand Co. produced a substantial tonnage of building and engine sand.

Chester.—The State highway department produced 2,370 short tons of paving sand for local use.

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Chesterfield.—The State highway department mined 1,626 short tons of paving sand for local use. Sand and gravel was produced by W. R. Bonsal Co. and Becker County Sand & Gravel Co. for building and paving purposes and for railroad ballast.

Dorchester.—Dorchester County ranked first in value of mineral products in 1954.

Shipments of portland cement by the Carolina Giant Cement Co. reached a new peak in 1954, surpassing the previous high of 1953 by 1 percent in tonnage and 2 percent in value.

The Salisbury Brick Corp. reported mining 33,000 short tons of miscellaneous clays valued at $20,000 for use in manufacturing brick and other heavy clay products. This production was an increase of 28 percent in tonnage and value over 1953.

The Carolina Cement & Lime Co. reported producing 38,000 short tons of crushed limestone valued at $76,000 for agricultural use.

Building sand totaling 6,000 short tons valued at $7,000 was reported mined and prepared by Baileys Sand Pit.

Fairfield.—Richland Shale Products Co. increased consumption of shale of its own production 7 percent in tonnage and 3 percent in value over 1953. Palmetto Quarries Co. increased production of crushed granite for concrete and road metal, railroad ballast, and stone sand by 15 percent above 1953. Rion Crushed Stone Corp. quarried a substantial tonnage of crushed granite for a variety of markets. The Winnsboro Granite Co. continued quarrying and preparing monumental granite and also produced some granite for marketing as rubble.

Florence.—The Coastal Sand Co. reported a substantial tonnage of sand for building and paving use and also railroad ballast.

Greenville.—The Paris Mountain Mining Co. reported the largest production of sheet mica in the State and a small tonnage of scrap mica. The State highway department reported the use of 1,465 short tons of paving sand in the county. James F. Zupan and E. C. Cooper reported a considerable production of sand for building purposes.

Greenwood.—The Southern Brick Co. and the Angus Brick & Tile Co., the only producers in the county, mined and used 84,000 short tons of miscellaneous clays valued at $63,000 for manufacturing brick and other heavy clay products. The tonnage produced by each company was approximately the same and represented a 29-percent increase in tonnage and a 27-percent rise in value above 1953. Colie Free Screened Creek Sand Co. reported the production and preparation of 5,000 short tons of building sand valued at $6,750, and Edie Moss reported a substantial tonnage of building sand.

TABLE 7.—Miscellaneous clays sold or used by producers in Greenwood County, 1949–54

Year	Short tons	Value	Year	Short tons	Value
1949	60,000	$45,000	1952	69,275	$52,956
1950	81,500	61,125	1953	65,000	49,662
1951	81,500	[1] 81,500	1954	84,000	63,000

[1] Estimated.

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Horry.—E. P. Pitts was the largest producer of glass sand in the State in 1954.

Jasper.—The Savannah & Atlanta Railroad mined and prepared engine sand for its own use. The Deerfield Sand Co. mined a considerable tonnage of building and paving sand.

Kershaw.—Bethune Potter reported a small production of refractory clay before abandoning his operation.

Lancaster.—The Ashe Brick Co. reported mining 60,000 short tons of miscellaneous clays for its own use in manufacturing brick and other heavy clay products. The Mineral Mining Corp. was a large producer of ground mica schist (sericite) for filler markets, in 1954.

Laurens.—There were two producers of vermiculite in 1954—the Alabama Vermiculite Co. and the National Vermiculite Co. Both had small tonnages, but the latter operation subsequently was reported as closed permanently.

Lee.—The State highway department produced and used 1,550 short tons of paving sand.

Lexington.—Weston & Brooker Quarry Co. reported 14 percent less tonnage of crushed granite for concrete, road metal, railroad ballast, and stone sand than in 1953. The State highway department reported production and use of 2,700 short tons of paving sand. Commercial sand and gravel production was reported by Foster Bros. Dixiana Sand Co., Southeastern Sand Co., Southern Silica Mining & Manufacturing Co., Columbia Silica Sand Co., and Capitol Sand Co. The county total was 9 percent less in tonnage and 7 percent less in value than in 1953.

TABLE 8.—Sand sold or used by producers in Lexington County, 1949–54

Year	Short tons	Value	Year	Short tons	Value
1949	254,086	$118,934	1952	240,322	$132,431
1950	229,068	112,747	1953	632,497	295,528
1951	265,852	116,039	1954	576,970	276,129

Marion.—Production of miscellaneous clays for the manufacture of brick and other heavy clay products by J. D. Murchison and the Standard Brick Co. was roughly six times greater than in 1953.

Marlboro.—The Palmetto Brick Co. and Cherow Brick Works reported mining miscellaneous clays for their own consumption in manufacturing brick and other heavy clay products at virtually the same rate as in 1953. Becker County Sand & Gravel Co. reported a substantial tonnage of sand and gravel for building and paving.

Oconee.—Benny Mason mined a small quantity of sheet mica. The State highway department produced and used 9,000 short tons of paving sand.

Orangeburg.—The State highway department reported production and use of 1,000 short tons of paving sand.

Pickens.—Pickens County ranked sixth in value of mineral production in 1954. Campbell Limestone Co. continued to operate the Beverly quarry, producing crushed granite for riprap, concrete aggregate, and road metal.

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Richland.—Richland County ranked fifth in value of mineral production in 1954. Miscellaneous clays output for manufacturing brick and other heavy clay products in their own plants was reported by Columbia Pipe Co., R. M. Stork Fire Brick Works, Carolina Ceramics, Inc., and Guignard Brick Co. The quantity produced exceeded that in 1953 by 150 tons, but the total value declined roughly 5 percent below 1953. The Columbia Pipe Co. produced a small tonnage of refractory kaolin. The Palmetto Quarries Co. quarried crushed granite for riprap, concrete aggregate, road metal, and railroad ballast. Production was at the same rate as in 1953. The Harrison Sand Co. and the Strickland Sand Co. mined building and paving sand and in addition some filter sand.

Spartanburg.—Spartanburg County ranked fourth in value of mineral production in 1954. Campbell Limestone Co. quarried and crushed approximately 350,000 short tons of granite for riprap, concrete aggregate and road metal, or roughly 13 percent more than in 1953. Total value was 18 percent greater. The State highway department produced and used 1,800 short tons of paving sand.

The American Vermiculite Co. and the Zonolite Co. mined and cleaned vermiculite at about the same rate as in 1953.

Sumter.—The State highway department mined and used 650 short tons of paving sand. Becker County Sand & Gravel Co. reported a substantial production of sand and gravel for building and paving use and railroad ballast.

York.—Commercialores, Inc., continued to mine kyanite from the Henry Knob mine, but production in 1954 was roughly 35 percent less than in 1953. The State highway department mined and used 500 short tons of paving sand.

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The Mineral Industry of South Dakota

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the South Dakota State Geological Survey.

By D. H. Mullen[1]

THE $37.9 million value of mineral production in South Dakota in 1954 was 12 percent over that in 1953. This established a new high for the State and marked the third consecutive year in which the total value increased. Of the total value of all minerals produced in 1954, the metals (of which 99 percent were gold and silver) represented 51 percent, sand and gravel 21 percent, and stone 12 percent.

TABLE 1.—Mineral production in South Dakota, 1953–54[1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Beryllium concentrate—gross weight	392	$157,656	337	$139,663
Clays	330,983	2,826,074	(2)	(2)
Coal (lignite)	23,671	82,117	(2)	(2)
Columbium-tantalum concentrate—pounds, gross weight	4,431	9,022	25,447	43,260
Feldspar—long tons	50,601	321,026	(2)	(2)
Gold (recoverable content of ores, etc.)—troy ounces	534,987	18,724,545	541,445	18,950,575
Gypsum			8,518	11,073
Iron ore (usable)—long tons, gross weight	1,060	(2)		
Lead (recoverable content of ores, etc.)	10	2,620		
Mica:				
Hand-cobbed	[3] 124	77,352	[3] 107	65,222
Scrap	1,687	27,388	1,510	26,943
Natural gas—million cubic feet	5	250	7	350
Sand and gravel	5,402,378	[4] 2,817,726	19,110,358	7,840,393
Silver (recoverable content of ores, etc.)—troy ounces	138,642	125,478	151,407	137,031
Stone	[5] 1,189,444	[5] 4,997,497	1,614,818	4,928,855
Tungsten concentrate—60-percent WO_3 basis	2	(2)	(6)	500
Undistributed: Cement, gem stones (1953), lime, lithium minerals, petroleum (1954), vanadium (1954), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2)		[4][7] 3,654,587		6,110,825
Total South Dakota		[4][8] 33,823,000		[8] 37,859,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers). Excluded, value of uranium.
[2] Value included with "Undistributed."
[3] Sheet equivalent, 11,174 pounds (1953), 16,299 pounds (1954).
[4] Revised figure.
[5] Except limestone for cement and lime.
[6] Less than 1 ton.
[7] Excludes clay for cement.
[8] The total has been adjusted to eliminate duplication of value in clays and stone.

[1] Commodity-industry analyst, Region III, Bureau of Mines, Denver, Colo.

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Most of the gain in value in 1954 was accounted for in the value of nonmetals. The value of fuels was less than 1 percent in both 1953 and 1954. A Mineral Atlas [2] of mines and mineral deposits in Lawrence, Meade, and parts of Butte and Pennington Counties was published.

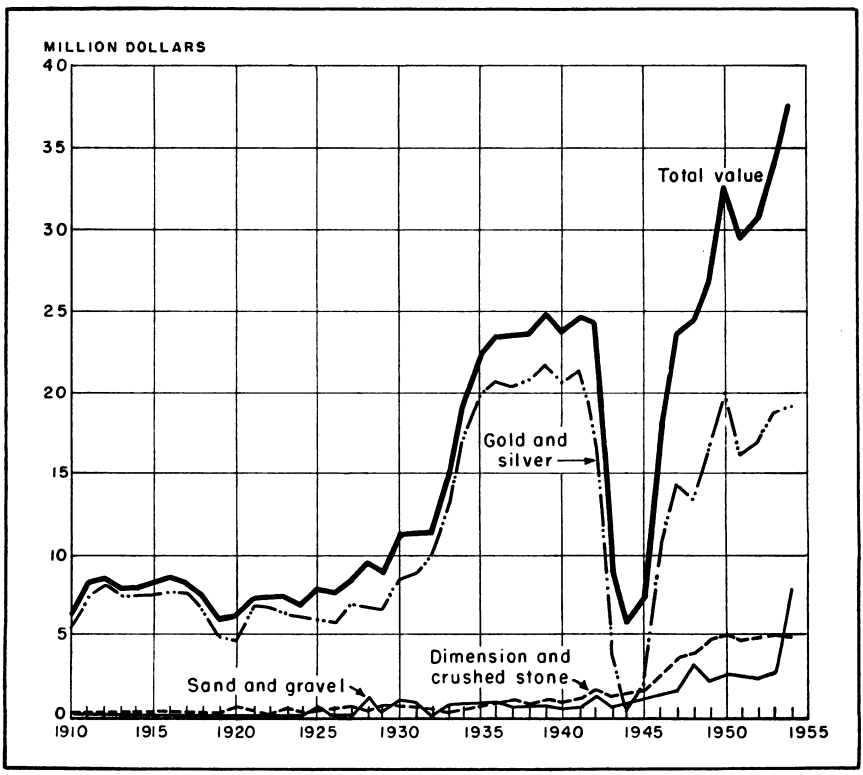

FIGURE 1.—Value of gold and silver, dimension and crushed stone, sand and gravel, and total value of mineral production in South Dakota, 1910–54.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Mines data for 1954, in some instances, are not directly comparable with those for 1953 because of differences in coverage.

The Defense Minerals Exploration Administration (DMEA) approved 1 exploration contract in South Dakota in 1954. The contract was for exploring uranium deposits in Fall River County; the total was $7,160.

[2] Bureau of Mines Staff, Region V, Mining Division, Rapid City, S. Dak., Black Hills Mineral Atlas, Part 1. Bureau of Mines Inf. Cir. 7688, 1954, 123 pp.

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REVIEW BY MINERAL COMMODITIES

METALS

Beryllium.—Beryllium concentrate was recovered by hand-sorting beryl from pegmatite dikes in Custer and Pennington Counties. The major portion of the production was sold to the General Services Administration Purchase Depot at Custer. Beryl Ores Co., Arvada, Colo., and Gladys Wells McKinley, Custer, purchased concentrate from producers for their own use and for resale to consumers. Fifty-six operators reported production from 51 properties; other operators produced smaller quantities.

Production in 1954 was 337 tons valued at $140,000, a decrease of 14 percent in quantity and 11 percent in value from 1953. Beryl has been produced in South Dakota largely as a byproduct or coproduct of feldspar and mica output. The Bureau of Mines operated the pilot plant at its experiment station in Rapid City and continued its investigation of the concentration of beryl, feldspar, and mica from pegmatites. A progress report of the activities and results of the work for the fiscal years 1952–53 was published.[3]

Columbium-Tantalum.—Columbite-tantalite concentrate was produced in Custer and Pennington Counties. All of this output was purchased by GSA at Custer. Production was reported by 12 operators at 10 properties. The mineral occurs sporadically in pegmatites and was produced as a byproduct of feldspar and mica mining. Production of 25,000 pounds in 1954 was nearly 6 times as much as in 1953. Production at one mine in Custer County accounted for all the increase.

Gold and Silver.—Gold and silver were produced from two mines in Lawrence County. Production in 1954 was 541,400 fine ounces of gold valued at $19 million and 151,400 fine ounces of silver valued at $137,000. The combined value was an increase of 1 percent over 1953

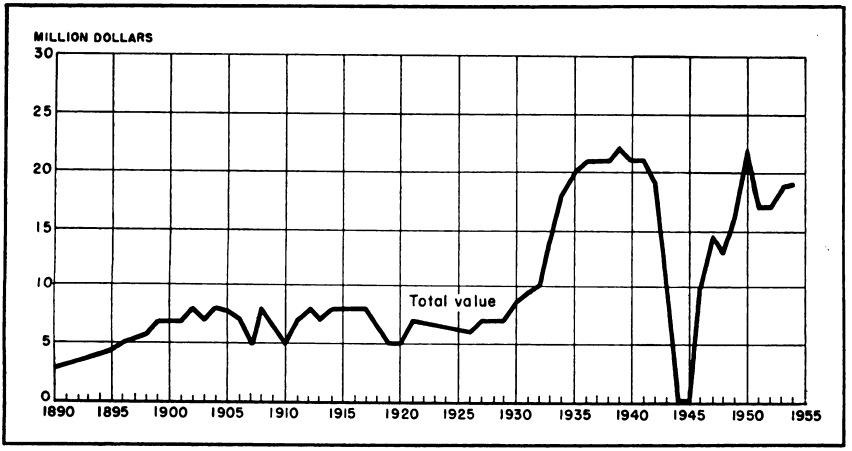

FIGURE 2.—Total value of mine production of gold and silver in South Dakota, 1890–1954.

[3] Runke, S. M., Binyon, E. O., and Cunningham, J. B., Progress Report on Pegmatite Investigations in South Dakota for Fiscal Years 1952–53: Bureau of Mines Rept. of Investigations 5061, 1954, 21 pp.

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and represented 51 percent of the total value of mineral production in South Dakota in 1954. Lawrence County maintained its lead as the major gold-producing area in the United States, and the Homestake Mining Co. continued to be the leading gold producer. Home-

TABLE 2.—Mine production of gold and silver in 1954, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Month	Gold (fine ounces)	Silver (fine ounces)
January	47,586	12,460	August	45,839	13,520
February	39,845	10,120	September	47,483	13,744
March	45,339	11,460	October	41,424	12,670
April	49,430	13,335	November	44,938	13,595
May	42,039	10,875	December	45,311	13,679
June	47,851	12,325			
July	44,360	13,624	Total	541,445	151,407

TABLE 3.—Mine production of gold, silver, copper, lead, and zinc, 1945–49 (average), 1950–54, and total 1876–1954, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945–49 (average)	5	[3]	871,950	323,578	$11,325,223	85,845	$74,976
1950	2		1,391,162	567,996	19,879,860	142,065	128,576
1951	5	3	1,166,380	458,101	16,033,535	139,590	126,336
1952	6		1,324,817	482,534	16,888,690	132,102	119,559
1953	4		1,479,802	534,987	18,724,545	138,642	125,478
1954	2		1,600,784	541,445	18,950,575	151,407	137,031
1876–1954			[4]	24,881,058	652,434,239	10,707,575	7,822,811

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945–49 (average)			6	$1,859	10	$2,462	$11,404,520
1950							20,008,436
1951			2	692			16,160,563
1952			2	644			17,008,893
1953			10	2,620			18,852,643
1954							19,087,606
1876–1954	106	$36,466	497	71,752	265	56,406	660,421,674

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, and ore shipped directly to smelters during the calendar year indicated.
[2] Does not include gravel washed.
[3] Less than 1.
[4] Figure not available.

TABLE 4.—Gold and silver bullion produced at mills by amalgamation, 1945–49 (average) and 1950–54

Year	Material sold or treated (short tons)	Gold in bullion (fine ounces)	Silver in bullion (fine ounces)	Year	Material sold or treated (short tons)	Gold in bullion (fine ounces)	Silver in bullion (fine ounces)
1945–49 (average)	790,022	211,708	50,089	1952	1,209,926	328,844	64,584
1950	1,265,118	389,473	111,080	1953	1,368,059	365,442	74,608
1951	1,046,305	317,593	62,685	1954	1,485,226	363,831	80,168

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stake Mining Co. treats its ores by both amalgamation and cyanidation, and there is some duplication of the quantities of material treated in tables 4 and 5.

TABLE 5.—Gold and silver bullion produced at mills by cyanidation, 1945–49 (average) and 1950–54

Year	Material treated (short tons)			Gold in bullion (fine ounces)	Silver in bullion (fine ounces)
	Crude ore	Sands and slimes	Total		
1945–49 (average)	80,882	775,646	856,528	111,842	35,421
1950	126,044	1,265,118	1,391,162	178,523	30,985
1951	120,051	1,045,384	1,165,435	140,493	76,436
1952	114,863	1,209,884	1,324,747	153,690	67,183
1953	111,676	1,368,059	1,479,735	169,542	63,434
1954	115,558	1,485,226	1,600,784	177,614	71,239

Tungsten.—A small quantity of tungsten concentrate produced in Pennington County was shipped to Colorado for upgrading.

Uranium.—Exploration, development, and mining of the carnotite-type uranium ores in Fall River County continued. Investigations by the Atomic Energy Commission (AEC) continued. Greater emphasis was directed toward reconnaissance, geological and geophysical studies, and research, with only limited exploratory drilling. Airborne radioactivity surveys of the Black Hills and the White River Badlands areas for the AEC by the Federal Geological Survey were completed. The buying station at Edgemont was operated the entire year by the American Smelting & Refining Co. as agents for AEC. Improved equipment was installed at the station to accommodate railroad shipments from Wyoming and other areas. The AEC gave serious consideration to several proposals to build a mill at Edgemont to treat South Dakota and Wyoming ores. Lignite containing U_3O_8 in excess of 0.10 percent was discovered in the North Cave Hills, Harding County. Reports concerning the uranium content of lignites in Harding County [4] and the occurrence of radioactive minerals in Lawrence County [5] were published.

DMEA approved a contract for exploration for uranium in Fall River County. The total of the contract was $7,160.

NONMETALS

Cement.—General-use and moderate-heat, high-early-strength, and high-sulfate-resistance portland cements were produced by the South Dakota Cement Plant at Rapid City. A portion of the general-use and moderate-heat cement was air-entrained. Masonry cement was made from a base of portland-cement clinker. Shipments of portland cement in 1954 exceeded production. The average value per barrel in 1954 was $2.84 compared with $2.67 in 1953. Increased shipments in 1954 reflect the expansion in building activity in South Dakota and adjacent States.

[4] Schopf, James M., and Gray, Ralph J., Microscopic Studies of Uraniferous Coal Deposits: Geol. Survey Circ. 343, 1954, 10 pp.

[5] Vickers, R. C., Occurrences of Radioactive Minerals in the Bald Mountain Gold-Mining Area, Northern Black Hills, South Dakota: Geol. Survey Circ. 351, 1954. 8 pp.

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Clays.—Bentonite and miscellaneous clay were produced in Butte and Pennington Counties. Two plants for processing bentonite were operated at Belle Fourche. The major portion of the bentonite processed was from deposits in Wyoming. The processed bentonite was utilized in foundries and insecticides, for rotary-drilling mud, as a concrete admixture, and for other uses. Clay from the Fuson formation was mined near Belle Fourche for manufacturing building brick, drain tile, and other heavy clay products. Shale from the Pierre formation was mined near Rapid City for manufacturing cement and lightweight aggregates. A report of investigations on lightweight aggregates in North and South Dakota was published.[6]

Feldspar.—Feldspar for use in glass, pottery, and enamel was mined in Custer and Pennington Counties. Production was reported by 35 producers from 45 deposits. With one exception, all crude production was ground at plants in Custer and Keystone. Production was less than in 1953.

Gem Stones.—Rose quartz, several types of agate, agatized wood, and garnets were produced in Custer and Pennington Counties. Sales were for souvenirs and specimens and to processors for polishing.

Gypsum.—Gypsum was mined from the Spearfish formation north of Rapid City for use in manufacturing cement. Production in 1954 was 8,518 tons.

Lime.—Quicklime, used entirely within the State for metallurgical purposes, was produced at Pringle, Custer County.

Lithium.—Production of lithium minerals (spodumene, amblygonite, and lepidolite) in Custer and Pennington Counties continued, with Pennington County producing the major portion. Spodumene was shipped to chemical plants in Minnesota and New Jersey for processing, the amblygonite was shipped to Germany, and the lepidolite was stockpiled. Production in 1954 was about 5 percent less than in 1953.

Mica.—Hand-cobbed and scrap micas were produced from numerous pegmatite deposits in Custer and Pennington Counties. Hand-cobbed mica was sold to the GSA Purchasing Depot at Custer. Block and film mica (Heavy-Stained and Better) recovered from the hand-cobbed mica purchased in 1954 was 7.7 percent and was 56 percent greater than that recovered from hand-cobbed mica purchased in 1953. Punch and scrap mica resulting from the rifting and trimming operations of the Custer Ore-Purchasing Depot were retained by GSA for future disposal. In May 1954 the regulations governing the payment for hand-cobbed mica purchased by GSA were revised.[7] The revision retained the maximum payment of $600 a ton for mica that met minimum specifications but reduced the payment for mica of lower yield and was designed to induce producers to prepare their mica more carefully. Scrap mica was produced by 10 operators and sold to grinders and local purchasers. A small quantity of scrap mica was ground in an experimental plant at Custer and sold to consumers for use in roofing and for insulation.

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[6] Cole, W. A., and Zetterstrom, J. D., Investigation of Lightweight Aggregates in North and South Dakota: Bureau of Mines Rept. of Investigations 5065, 1954, 43 pp.

[7] General Services Administration, Mica Regulation; Purchase Programs for Domestic Mica: Official Register, Title 32A, National Defense Appendix, Chap. 14, General Services Administration, Revision 3, May 26, 1954.

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TABLE 6.—Mica sold or used by producers, 1950–54

	1950	1951	1952	1953	1954
Sheet mica:					
Uncut punch and circle:					
Pounds	12,560	----------	----------	----------	----------
Value	$1,375	----------	----------	----------	----------
Average per pound	$0.11	----------	----------	----------	----------
Uncut, larger than punch and circle:					
Pounds	458	----------	[1] 490	[1] 921	[1] 332
Value	$309	----------	$6,580	$8,983	$3,056
Average per pound	$0.67	----------	$13.43	$9.75	$9.20
From hand-cobbed mica:					
Pounds	----------	----------	[2] 3,818	[2] 10,253	[3] 15,967
Value	----------	----------	$25,454	$68,369	$62,166
Average per pound	----------	----------	$6.67	$6.67	$3.89
Total:					
Pounds	13,018	----------	4,308	11,174	16,299
Value	$1,684	----------	$32,034	$77,352	$65,222
Average per pound	$0.13	----------	$7.44	$6.92	$4.00
Scrap mica, total:					
Short tons	1,902	2,292	915	1,687	1,510
Value	$24,989	$42,714	$24,148	$27,388	$26,943
Average per ton	$13.14	$18.64	$26.39	$16.23	$17.84
Total sheet and scrap mica:					
Short tons	1,909	2,292	917	1,693	1,518
Value	$26,673	$42,714	$56,182	$104,740	$92,165

[1] Major part of this production sold to GSA as full-trimmed sheet.
[2] Sold to GSA. Sheet mica from hand-cobbed mica was estimated to be 4½ percent of the total hand cobbed mica purchased by GSA. This is the minimum GSA specification.
[3] Sold to GSA. Heavy-Stained and Better recovered from total hand-cobbed mica purchased by GSA.

Perlite.—A small quantity of crude perlite from Colorado deposits was expanded at a plant in Rapid City for use as an aggregate for plaster and concrete.

Sand and Gravel.—Production of sand and gravel was reported by individual operators in 31 of the State's 67 counties. Production was reported by State, county, and municipal highway departments in 49 counties. Major uses included building, paving and road construction, and railroad ballast. Of the total production, 92 percent was reported as washed, screened, or otherwise prepared. Transportation was almost entirely by truck (99 percent). A sharp increase was recorded in production by Government-and-contractor operators. The increase reflects, in part, expansion in highway construction; however, the greater part of the increase must be assigned to improved coverage of the industry through participation of the Bureau of the Census, United States Department of Commerce, for the census year 1954. Sand and gravel produced by the State highway commission and under contract for the commission for highway construction throughout the State was 10 million tons.

The 10 leading commercial producers in the State were W. E. Bartholow & Son Construction Co., Batie Gravel Co., Ed Birdsall Sand Co., Concrete Materials Co., R. E. Casey Construction Co., Eagle Sand & Gravel Co., Zeller Concrete Materials Co., Glen F. & George W. Niederauer, Fred Wattier, and American Sand & Gravel Co., Inc.

Stone.—Granite for building and monumental use was quarried in Grant County. The granite (deep-red to reddish brown and mahogany), was used extensively for exterior and interior building facings and for monuments.

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TABLE 7.—Sand and gravel sold or used by producers, 1953–54, by classes of operation and uses

Class of operation and use	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Building	374,314	$307,498	$0.82	425,250	$370,569	$0.87
Paving	97,304	73,261	.75	124,074	107,105	.86
Filter				(1)	(1)	(1)
Railroad ballast	11,000	8,000	.73			
Other	180	151	.84			
Gravel:						
Building	61,373	80,175	1.31	86,529	97,382	1.13
Paving	1,826,987	[2] 1,189,671	.66	839,139	304,509	.36
Railroad ballast	84,820	60,365	.71	(1)	(1)	(1)
Other	5,000	5,000	1.00			
Undistributed [1]				51,833	27,323	.53
Total commercial sand and gravel	2,460,978	[2] 1,724,121	.70	1,526,825	906,888	.59
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building				(1)	(1)	(1)
Paving	66,874	43,628	.65	5,031,892	1,728,926	.34
Gravel:						
Building	750	203	.27	(1)	(1)	(1)
Paving	2,873,776	1,049,774	.37	12,512,679	5,200,809	.42
Undistributed [1]				38,962	3,770	.10
Total Government-and-contractor sand and gravel	2,941,400	1,093,605	.37	17,583,533	6,933,505	.39
Grand total	5,402,378	[2] 2,817,726	.52	19,110,358	7,840,393	.41

[1] Figures that may not be shown separately are combined as "Undistributed."
[2] Revised figure.

A substantial portion of the rough stone produced was cut and polished at Minnesota plants. The remainder was finished in South Dakota or shipped to other processing centers. Crushed sandstone for riprap, concrete aggregate, road construction, railroad ballast, and furnace lining was produced in Hanson and Minnehaha Counties. A small quantity of quartz from pegmatities in Custer and Pennington Counties was used for building and ornamental purposes. Crushed limestone was produced in Lawrence, McCook, and Pennington Counties for riprap, concrete aggregate, stone sand, and sugar refining and for manufacturing cement and lime. Miscellaneous stone for concrete aggregate and road construction was produced in Beadle and Lawrence Counties.

MINERAL FUELS

Coal.—Coal (lignite) was produced in Clay, Corson, and Dewey Counties. Principal operations were at Firesteel and Isabel in Dewey County. Confidentiality arising from the Census precludes the publication of a figure on lignite for 1954 comparable with 1953. Production and value of South Dakota lignite for 1954 are included in the United States total in order to avoid disclosure, on the basis of Census data, of individual company operations in other States.

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Natural Gas.—Natural gas was produced in Hughes County near Pierre. The gas (methane) derived from organic material trapped in the glacial drift was recovered from shallow wells and used locally for domestic heating and cooking.

Petroleum.—In 1954 South Dakota reported its first commercial production of petroleum. Exploration by geological investigation and drilling in the northwestern and north central counties on the western side of the Williston Basin structure had been intense for several years. Completion of the Shell No. 1 State "A" well northwest of Buffalo in Harding County in March 1954 established South Dakota as an oil-producing State. Initial production was at a rate of 80 barrels per day of 31.6 gravity oil. A development well ½ mile south of the discovery well was completed and produced at the rate of 134 barrels of 28.0 gravity oil per day. Production was from the Red River member of the Ordovician at a depth of 8,500 feet. Twenty-three wells totaling 99,280 feet in depth were drilled in 12 counties in 1954. Except for the 2 producing wells in Harding County, minor "shows" of oil were found in only 4 wells (1 each in Butte and Harding Counties and 2 in Perkins County). Ten companies completed 236 crew weeks of seismograph work during the year. The Great Plains Refining & Development Co. announced late in the year that plans had been completed to build a refinery at Rapid City to process crude oil from eastern Wyoming fields. The daily capacity of the plant was to be 3,000 barrels.

REVIEW BY COUNTIES

In the following counties sand and gravel and/or crushed stone were produced by and for the State highway commission, county and municipal governments, and commercial producers for highway construction and repair, building, and railroad ballast:

Aurora	Deuel	Lyman
Beadle	Douglas	Marshall
Bon Homme	Edmunds	McPherson
Brookings	Gregory	Mellette
Brown	Haakon	Miner
	Hamlin	Moody
Campbell	Hand	Roberts
Charles Mix	Hanson	Spink
Clark	Hutchinson	Sully
Clay	Jackson	Turner
Codington	Jerauld	Union
Davison	Lake	Walworth
Day	Lincoln	Yankton

Four exploratory oil wells (1 each in Jones and Potter Counties and 2 in Stanley County), ranging in depth from 2,500 to 4,000 feet, were drilled in 1954. All were dry and were abandoned.

Butte.—Eastern Clay Products Department, International Minerals & Chemical Corp., and American Colloid Co. operated processing mills for bentonite at Belle Fourche. Some of the raw material processed was from South Dakota deposits, but the major portion was from Wyoming deposits. Black Hills Clay Products Co. mined shale from the Fuson formation near Belle Fourche for the manu-

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facture of building brick, drain tile, and other heavy clay products. J. B. O'Connor produced structural sand and gravel. The county highway department produced road gravel.

R. R. Harmon drilled the No. 1 Fishel well. A slight oil stain was found from 1,228 to 1,250 feet. The well was abandoned at 1,475 feet after a drill-stem test at 1,210 to 1,259 feet failed when the hole caved.

Corson.—Youngblood & Youngblood drilled the No. 1 John Draskovich well. Slight shows of gas and black oil were found at 5,118 to 5,145 feet at the top of the Mission Canyon. The well was abandoned at 7,465 feet at the lower Winnipeg shale. The county highway department produced paving gravel.

TABLE 8.—Value of mineral production in South Dakota, 1953–54, by counties [1] [2]

County	1953	1954	Minerals produced in 1954 in order of value
Aurora		$30,347	Sand and gravel.
Beadle	(3)	106,246	Sand and gravel, stone.
Bon Homme	$267,622	477,164	Sand and gravel.
Brookings	(3)	121,887	Do.
Brown	78,011	264,130	Do.
Buffalo	165		
Butte	2,820,579	1,216,347	Clays, sand and gravel.
Campbell	(3)	6,329	Sand and gravel.
Charles Mix		7,802	Do.
Clark	20,527	16,138	Do.
Clay	(3)	5,370	Sand and gravel, coal.
Codington	(3)	166,450	Sand and gravel.
Corson	268	4,800	Sand and gravel, coal.
Custer	614,607	429,294	Feldspar, beryl, mica, columbium-tantalum, lime, lithium, stone.
Davison	34,363	8,603	Sand and gravel.
Day	75,413	90,481	Do.
Deuel	(3)	11,658	Do.
Dewey	(3)	(3)	Coal.
Douglas	12,492	14,458	Sand and gravel.
Edmunds		8,594	Do.
Fall River	130,707	29,612	Do.
Grant	2,930,786	2,311,091	Stone, sand and gravel.
Gregory	5,513	33,493	Sand and gravel.
Haakon		4,729	Do.
Hamlin	(3)	20,315	Do.
Hand	3,093	1,130	Do.
Hanson	235,511	319,100	Stone, sand and gravel.
Harding		(3)	Petroleum.
Hughes	(3)	(3)	Natural gas.
Hutchinson	(3)	(3)	Sand and gravel.
Hyde		3,922	Do.
Jackson	(3)	23,000	Do.
Jerauld	17,878	9,692	Do.
Kingsbury	(3)	(3)	Do.
Lake	(3)	44,772	Do.
Lawrence	19,057,910	19,197,106	Gold, silver, stone, sand and gravel.
Lincoln	63,296	41,010	Do.
Lyman		29,464	Do.
Marshall	(3)	5,228	Do.
McCook	(3)	280,665	Stone.
McPherson	31,771	2,825	Sand and gravel.
Meade	2,318	3,820	Do.
Mellette		1,770	Do.
Miner		550	Do.
Minnehaha	1,641,653	(3)	Stone, sand and gravel.
Moody	(3)	88,844	Sand and gravel.
Pennington	4,737,442	6,537,872	Cement, sand and gravel, stone, lithium, clays, feldspar, beryl, gypsum, mica, columbium-tantalum, tungsten.
Perkins		18,660	Sand and gravel.
Roberts		(3)	Do.
Spink	(3)	20,496	Do.
Sully	(3)	10,777	Do.
Tripp	(3)		

See footnote at end of table

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TABLE 8.—Value of mineral production in South Dakota, 1953–54, by counties [1] [2]—Continued

County	1953	1954	Minerals produced in 1954 in order of value
Turner	(3)	$50,637	Sand and gravel.
Union	$9,683	24,414	Do.
Walworth	(3)	33,700	Do.
Yankton		7,000	Do.
Undistributed	[4] [5] 1,031,730	6,112,898	
Total	[4] 33,823,000	[6] 37,859,000	

[1] The following counties are not listed because no production was reported: Bennett, Brule, Faulk, Jones, Potter, Sanborn, Shannon, Stanley, Todd, Washabaugh, Ziebach.
[2] Values of gem stones (1953), some sand and gravel (1954), and vanadium (1954) are excluded from county totals and included with "Undistributed" to avoid disclosure of individual company operations. Excludes uranium.
[3] Included with "Undistributed."
[4] Revised figure.
[5] Adjusted to avoid duplicating value of clays.
[6] Adjusted to avoid duplicating value of clays and stone.

Custer.—Beryl, columbite-tantalite, feldspar, mica, spodumene, and quartz were produced from the numerous pegmatite deposits in the county. Recorded production shows that 35 operators worked 31 pegmatite deposits. Some produced only 1 mineral, others produced 2 to 4 minerals from the same deposit. George Bland operated the Beecher No. 3 and Mohawk mines, producing beryl, feldspar, mica, and spodumene. Abingdon Potteries operated the Abingdon mine, shipping the feldspar produced to the Abingdon grinding plant at Abingdon, Ill. Lithium Corp. of America, Inc., operated the Beecher No. 2 mine until June 19, shipping spodumene ore to its flotation plant at Hill City. John Ross operated the Highland Lode and produced beryl, columbite-tantalite, feldspar, and mica. Mineral Mills, Inc., produced beryl, columbite-tantalite, and mica at the Old Mike and Glenwood mines. Consolidated Feldspar Department, International Minerals & Chemical Corp., produced beryl at the Bull Moose mine and feldspar at the Triangle A, St. Louis, and Shamrock mines; it also operated its grinding plant at Custer. Lowell Treloar operated the Little Marvel mine and produced beryl, columbite-tantalite, and feldspar. Russell Wineteer & Lloyd Hampton operated the Ogg mine, producing beryl, columbite-tantalite, and feldspar. During the year there were 35 producers of beryl, 7 producers of columbite-tantalite, 21 producers of feldspar, 32 producers of mica (of which 23 produced hand-cobbed mica, 10 produced scrap mica, and 1 produced both hand-cobbed and scrap mica), and 2 producers of spodumene. The principal producers of beryl were George Bland, Mineral Mills, Inc., and Russell Wineteer & Lloyd Hampton. Lowell Treloar was the major producer of columbite-tantalite and supplied all of the increase in production over 1953. Abingdon Potteries and Consolidated Feldspar Department of International Minerals & Chemical Corp. were the largest feldspar producers. George Bland was the only substantial producer of scrap mica, and Lithium Corp. of America, Inc., was the major producer of spodumene. The three leading producers of hand-cobbed mica were Charles Vogel, Carl Roseberry, and Dale McDermond.

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Beryl production was sold to the GSA Purchasing Depot at Custer, Gladys Wells McKinley of Custer, and Beryl Ores Co. of Arvada, Colo. GSA purchased 58 percent of the beryl produced, all of the columbite-tantalite, and all of the hand-cobbed mica. Scrap mica was sold to Consolidated Feldspar Department, International Minerals & Chemical Corp., Gladys Wells McKinley, U. S. Mica, Inc., and Richmond Mica Co. Except for the feldspar production by Abingdon Potteries, all feldspar was produced or purchased by Consolidated Feldspar Department, International Minerals & Chemical Corp.

The Black Hills Lime Co. at Pringle produced quicklime. The entire production was used within the State for metallurgical purposes. The American Mining & Smelting Co. reported exploration and testing activities at the Spokane mine. Scott's Rose Quartz Co. produced quartz for ornamental purposes.

Emil Kucera drilled the No. 2-A Sara Coffing well. It was abandoned as a dry hole at 1,980 feet.

Dewey.—Coal (lignite) was produced from strip mines by the Dewey County Coal Co., at Firesteel and the Baker coal mine at Isabel.

Fall River.—Exploration, development, and mining of carnotite-type uranium deposits progressed rapidly during the year. The buying station operated by the American Smelting & Refining Co. for AEC at Edgemont purchased ore the entire year. Purchases also were made of ores that originated in Wyoming. The growing stockpile accelerated the desirability of constructing milling facilities to serve the Edgemont and nearby Wyoming areas. Edgemont Mining Co., Mining Research Corp., and Black Hills Uranium Co. entered into a milling agreement. The agreement encompassed 90 percent of the known ore reserves of the Edgemont district. These three companies then entered into an agreement with the Climax Molybdenum Co. for constructing a mill at Edgemont if a satisfactory contract for the sale of concentrate could be made with the AEC. Other companies, combinations of companies, and producers also prepared proposals for constructing milling facilities in the district. At the end of the year, the AEC was reported giving consideration to the several proposals submitted.

Edgemont Mining Co. operated the Gould lease, Virginia C claims, and Taylor and Crandall groups and was the principal producer in the district. Sodak Mining Co. operated the Matias Peak group and numerous claims throughout the district. Black Hills Uranium Corp. acquired the Chord claims in Red and Driftwood Canyons. Mining Research Corp. continued to investigate the possibility of leaching uranium ores in place and the development of processes for treating low-grade ores. The corporation consolidated its holdings, leased from numerous owners in the Edgemont district, into a block of about 7,000 acres. Some vanadium was recovered from ores shipped to Colorado and Utah mills for processing. The DMEA approved a contract with the Urova Co. to explore uranium deposits.

John Burrows drilled the No. 1 Government well to a depth of 785 feet, where it was abandoned as a dry hole. The Fall River Sand & Gravel Co. and Reitz & Crites Sand Co. produced building and paving sand and gravel and railroad ballast.

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Grant.—Rough and dressed architectural and monumental granite was produced from quarries near Milbank and Big Stone City. The granite is red to reddish-brown and mahogany and was widely used for monuments and building facings. A substantial portion of the rough stone quarried in South Dakota was finished at plants in Minnesota. Consolidated Quarries, Inc., produced rough stone at its Milbank quarry. The stone (Dakota Mahogany) was finished at Sauk Rapids, Minn. Melrose Granite Co. operated the Melrose Russet quarry near Big Stone City. Rough stone was finished at the plant in St. Cloud, Minn. Steiner-Rausch Granite Co. operated its quarry near Milbank. The rough stone (American Beauty Mahogany) was sold to finishing plants for architectural and monumental use. Robert Hunter Granite Co. produced dressed monumental stone at its quarry near Milbank. Delano Granite Works, Inc., produced rough stone (Imperial Mahogany) at its Milbank quarry. The stone was dressed at the plant in Delano, Minn. Dakota Granite Co. operated the Dakota Mahogany and American Rose quarries at Milbank. The principal use was for monuments. J. E. Johnson, Walter Lindberg, Plut & Johnson, and Strege & Sons produced gravel for building and highway construction. The county highway department produced paving gravel.

Harding.—Shell Oil Co. completed its No. 1 State "A" well in March as the first commercial producer in South Dakota. Production was from the Red River member of the Ordovician through perforations from 8,587 to 8,600 and 8,660 to 8,681 feet. Initial production was 80 barrels per day of 31.6 gravity oil. The total depth of the well was 9,335 feet. A development well (the No. 32–16) ½ mile south of the discovery well, was completed at 8,720 feet and produced 134 barrels of 28.0 gravity oil at 8,548 to 8,561 and 8,666 to 8,677 feet in the Red River. Amerada Petroleum drilled the No. 1 South Dakota State "A" to a depth of 3,994 feet, where it was abandoned. Carter Oil Co. abandoned the No. 1 Charles W. Hendricks well at 9,052 feet. The No. 1 A. A. Clark–USA Unit C well was drilled by Stanolind Oil & Gas Co. to a depth of 9,304 feet and abandoned.

The cores obtained in drilling the uraniferous lignite beds in the Slim Buttes area by the Federal Geological Survey in 1951 and the Federal Bureau of Mines in 1952–53 for the AEC were studied and analyzed by the Federal Geological Survey and a report published.[8] In August samples of lignitic material were taken in the North Cave Hills that contained over 0.10 percent uranium oxide and was the first commercial discovery of uranium in the lignite beds. A land rush followed, which extended into western and southwestern North Dakota.

Hughes.—Production of natural gas from shallow wells near Pierre continued. The gas—methane—derived from organic material trapped in the glacial drift was used in Pierre for cooking and heating. Production in 1954 was about 7 million cubic feet.

Hyde.—The Hornet Oil & Gas Co. drilled the No. 1 Moses Aesoph well to a depth of 2,186 feet, where it was abandoned. The county highway department produced paving gravel and let contracts for

[8] Schopf, James M., and Gray, Ralph J., Microscopic Studies of Uraniferous Coal Deposits: Geol. Survey Circ. 343, 1954, 10 pp.

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road gravel to Harold Bowden, E. A. Weber, Floyd Meek, R. Beemer, and the Immaculate Conception School.

Kingsbury.—The No. 1 Dystra well was drilled by the Kingsbury Oil Development Co. to a depth of 1,095 feet, where it was abandoned. Sam C. Torgrude produced gravel for road construction. The county highway department produced paving gravel, and W. Kornder produced road gravel under contract.

Lawrence.—Gold, silver, crushed stone, and sand and gravel were produced from the mines and quarries of Lawrence County. The total value of all minerals was $192 million, an increase of about 1 percent over 1953. Lawrence County produced 51 percent of the total value of all minerals (except uranium) produced in the State.

The Homestake Mining Co., the leading producer of gold in the United States, operated the Homestake mine at Lead throughout the year. The production of gold was 1 percent greater and silver 9 percent greater than in 1954. The following data are extracted from the Seventy-Seventh Annual Report of the Homestake Mining Co. for the year ended December 31, 1954.

* * *

A substantially larger tonnage of ore was milled and economics of many sorts were made that had a beneficial effect on unit costs. Tonnage treated increased by 8.5 percent over 1954, but bullion output was only $158,000 higher since the value of the gold recovered per ton declined from $13.34 to $12.40.

* * *

Continued improvement in stoping methods as well as in details of mining and the utilization of the new crushing and grinding equipment in the mills throughout the year went far toward offsetting the unfavorable effects of the higher wage scale adopted in the last quarter of 1953 and of the rise in prices of most of the basic materials and equipment used in the operations.

Net earnings decreased only slightly, which in these grim times for gold miners must be regarded as something of an achievement. It is annoying to have to run faster and faster to stand still, but some measure of comfort perhaps is to be derived from recognizing the added skill with which the effort is being made. Figures for tons mined per man-hour and for quantities of ore handled in the various metallurgical operations showed gratifying improvements during the year that, to some extent at least, offset the adverse effects of inflationary trends beyond our control.

In 1954 the tonnage milled was 1,485,226, an increase of 117,167 tons over 1953. Bullion production was valued at $18,409,610.35, an increase of $157,626.11 over 1953. Recovered value per ton was $12.40. Extraction was 96.67 percent. Recovered value in 1953 was $13.34; extraction, 96.66 percent.

Cost per ton for mining was the same as in 1953. Milling cost was 15 cents lower. Administrative and general expense dropped proportionately to the increased tonnage. Tons per man shift underground, excluding sinking, increased from 5.65 in 1953 to 5.73 in 1954. The failure of this increased efficiency to lower the mining costs is due to a full 12 months at the higher wage scale granted in the last quarter of 1953.

The developed ore reserve (including broken ore) as of January 1, 1955 was 17,587,200 tons, a decrease of 850,050 tons from January 1, 1954.

The deep level program was pushed vigorously during the year. The Yates shaft was stripped to the 4,850 level. The access drift on the 4,850 level to the site of the new underground shaft reached the turn-off point to the hoist room location.

* * *

During the year modernization of slime and sand plant precipitation was completed. A new 50-foot thickener was installed. Substitution of cones with bowl classifiers was 50 percent completed. Many old pumps were replaced with modern ones. The anticipated benefits from grinding circuit changes made in 1953 have been fully realized.

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TABLE 9.—Ore milled, receipts, and dividends, Homestake mine, 1950–54 [1]

Year	Ore milled (short tons)	Receipts for bullion product		Dividends
		Total	Per ton	
1950	1,265,118	$19,264,048.20	$15.2271	$5,525,520
1951	1,046,203	15,486,682.10	14.8028	4,319,952
1952	1,209,884	16,379,986.02	13.5385	3,717,168
1953	1,368,059	18,251,984.24	13.3415	4,018,560
1954	1,485,226	18,409,610.35	12.3951	4,018,560

[1] From 1876 to 1954, inclusive, this mine yielded bullion and concentrates that brought a net return of $581,905,461 and paid $186,776,554 in dividends.

In the mine, replacement of old air locomotives with larger battery units continued. Also 150 new mine cars were placed in service.

The program of deepening the mine requires the furnishing of more adequate ventilation to the lower levels. An intensive study of this problem is in progress and recommendations will be presented in 1955.

On October 16, 1954 the Wyodak and Kirk Power Plants were transferred to the Black Hills Power and Light Company. The transfer was effected smoothly and service from the Power Company since that date has been very satisfactory.

* * *

The Bald Mountain Mining Co. operated the Portland-Dakota-Clinton-Decorah group of mines (classed as 1 mine) and its 370-ton all-slime cyanide mill at Trojan throughout the year. Production of gold was 15 percent greater and silver 13 percent greater than in 1953.

The American Mining & Smelting Co. reported that exploration and testing at the Silver Queen mine continued throughout the year. The company plans to erect a small smelter.

Cole Construction Co. produced crushed limestone for use as riprap, stone sand, road construction, and sugar refining.

The Lawrence County Highway Department produced sand and gravel and crushed stone for road construction.

Meade.—Lion Oil Co. drilled the No. 1 Government-Libertin well. It was abandoned as a dry hole at 4,346 feet. Daane Bros. Construction Co. produced paving gravel. A. W. Koat, Strong Bros., and Summit Construction Co. produced road gravel for the county.

Minnehaha.—Crushed sandstone for use as refractory stone (ganister), in concrete aggregate, road construction, railroad ballast, filters, and foundries was produced by Concrete Materials Co. and L. G. Everist, Inc. Building and paving sand and gravel was produced by Concrete Materials Co., Eagle Sand & Gravel Co., Frank E. Lacy, and Floyd Oberg. J. H. Beckman Construction Co. and Steve R. Oberg Construction Co. produced gravel for the State highway commission. Weelborg Bros. produced paving gravel for the county.

Pennington.—Cement, clays, crushed limestone, pegmatite minerals (beryl, columbite-tantalite, feldspar, lithium, and mica), and sand and gravel were the mineral products of Pennington County.

The South Dakota Cement Plant at Rapid City, owned by the State of South Dakota and operated by the State Cement Commission, produced several types of portland and masonry cements. A new limestone-crushing plant was installed. The commission pro-

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duced the limestone, sand, and gypsum used at the plant, contracted for the production of shale on land owned by the State. The trade area included all of South Dakota and extended into Colorado, Iowa, Minnesota, Montana, Nebraska, North Dakota, and Wyoming and to Canada.

Pegmatite minerals were produced from deposits in the Keystone area. Consolidated Feldspar Department, International Minerals & Chemical Corp., produced feldspar and beryl from a number of its own mines and operated its grinding plant at Keystone the entire year. All feldspar produced in the county by lessees and independent operators was purchased by the Consolidated Feldspar Department. The Black Hills Keystone Corp. operated the Bob Ingersoll mine, producing beryl, feldspar, amblygonite, and lepidolite. Maywood Chemical Works operated the Etta mine and produced spodumene, all of which was shipped to the company plant at Maywood, N. J., for processing. Keystone Feldspar & Chemical Co. produced feldspar, beryl, scrap mica, and amblygonite at the Peerless mine. Lithium Corp. of America, Inc., operated the Mateen mine and its flotation mill at Hill City until July 7, 1954, when operations were suspended because of lack of water. Feed for the mill was from the Beecher No. 2 mine in Custer County, the Mateen mine at Hill City, and heavy-medium tailing from the Edison mine at Keystone. Spodumene concentrate recovered at the Hill City mill was shipped to the plant at St. Louis Park, Minn., for processing. Facilities at the Beecher No. 2 mine and the Mateen mine, as well as the Hill City mill, were maintained for standby operation. Operations at the Edison mine were terminated June 19. Uranium & Allied Minerals, Inc., acquired the Holy Terror mill at Keystone and produced spodumene concentrate. Spodumene ore also was produced. Other independent operators produced beryl, columbite-tantalite, hand-cobbed and scrap mica, and feldspar. Beryl was sold to GSA at Custer, Gladys Wells McKinley of Custer, and Beryl Ores Co. of Arvada, Colo. GSA purchased 45 percent of the beryl produced in the county. The entire production of columbite-tantalite and hand-cobbed mica was sold to GSA. Scrap mica was sold to Gladys Wells McKinley and to grinders in Chicago and North Carolina.

Shale for manufacturing lightweight aggregates was mined near Rapid City by Light Aggregates, Inc. The expanded product was used in manufacturing building blocks. Hills Materials Co., Pete Lien & Sons, and Summit Construction Co. produced crushed limestone for concrete aggregate and road construction. W. E. Simpkins produced tungsten concentrate from the Friend Robertson mine. The concentrate was shipped to Colorado for upgrading and sale. Rushmore Perlite Products Co. expanded a small quantity of crude perlite from Colorado deposits at a plant in Rapid City for use as an aggregate in plaster and concrete. Ed Birdsall Sand Co. produced sand and gravel for building, paving, and railroad ballast. Northwestern Engineering Co., Dean R. Rounds, Floyd D. Stapp Construction Co., and Christle Construction Co. produced paving gravel for the State highway commission and the county highway department.

Perkins.—Five wells were drilled in Perkins County. Youngblood & Youngblood drilled the No. 1 J. J. Wheiner well to 7,830 feet and the No. 1 Fron Anderson well to 8,569 feet. Both holes were dry and were abandoned in the Lower Winnipeg sand. W. H. Hunt-Zack

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Brooks drilled the No. 1 Federal well. A slight show of oil was found at 8,831 to 8,880 in the Red River. The hole was abandoned at 9,431 feet in the Winnipeg Sand. Shell Oil Co. drilled the No. 1 Veal well to 8,317 feet where it was abandoned. J. P. Evans drilled the No. 1 J. R. Quergas Trust Howard Capp well to 7,318 feet and it was abandoned. The county highway department produced paving gravel. Stippichs Trucking Service produced sand and gravel for building purposes.

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The Mineral Industry of Tennessee

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Tennessee Division of Geology.

By Avery H. Reed, Jr.,[1] and William D. Hardeman, Jr.[2]

THE PRINCIPAL mineral products of Tennessee in 1954 were coal, cement, limestone and marble, and phosphate rock.

The total value of the mineral production of the State was $105.7 million, compared with $98 million in 1953. New alltime highs were attained in the production of cement, phosphate rock, and stone.

TABLE 1.—Mineral production in Tennessee, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Cement—376-pound barrels	7,276,964	$18,283,366	7,569,279	$19,734,262
Clays	1,037,450	3,478,622	1,015,256	3,780,952
Coal	5,466,569	25,151,682	6,428,831	25,477,006
Copper (recoverable content of ores, etc.)	7,829	4,493,846	9,087	5,361,330
Fluorspar (synthetic)	426	(2)	----	----
Gold (recoverable content of ores, etc.)—troy ounces	293	10,255	218	7,630
Iron ore—long tons, gross weight	12,751	82,499	(2)	(2)
Lead (recoverable content of ores, etc.)	9	2,358	----	----
Lime (open-market)	114,474	1,177,461	80,372	968,078
Manganese ore (metallurgical)—gross weight	2,625	201,898	11,823	919,949
Natural gas—million cubic feet	89	11,000	89	10,000
Petroleum (crude)—thousand 42-gallon barrels	16	(3)	(2)	(2)
Phosphate rock—long tons	1,518,912	11,305,098	1,633,226	11,743,012
Sand and gravel	5,231,329	5,629,687	5,155,185	6,141,139
Silver (recoverable content of ores, etc.)—troy ounces	68,935	62,390	60,759	54,990
Stone	[3] [4] 10,485,351	[3] [4] 16,948,053	14,040,187	22,046,016
Zinc (recoverable content of ores, etc.)	38,465	8,846,950	30,326	6,550,416
Undistributed: Barite, pyrite, stone (granite, 1953), and minerals whose values must be concealed for particular years (indicated in appropriate column by footnote reference.[2] Excludes value of clay used for cement (1953).	----	2,364,412	----	5,479,590
Total Tennessee	----	98,050,000	----	[5] 105,686,000

[1] Production as measured by marketable production, mine shipments, or mine sales (including consumption by producers).
[2] Figure withheld to avoid disclosure of individual company operations. Value included with "Undistributed."
[3] Incomplete figure, excludes granite, value for which is included with "Undistributed."
[4] Except limestone for cement and lime.
[5] The total has been adjusted to eliminate duplication in the value of clays and stone.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Knoxville, Tenn.
[2] Director, Division of Geology, Department of Conservation, Nashville, Tenn.

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The leading mineral-producing companies were: Tennessee Copper Co., producing gold, silver, copper, zinc, and pyrite; Penn-Dixie Cement Corp., operating 2 portland-cement plants; Marquette Cement Mfg. Co., operating 2 cement plants and a sand and gravel plant; Monsanto Chemical Co., producing phosphate rock; and American Zinc Co. of Tennessee, producing limestone and zinc.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences of coverage.

TABLE 2.—Average unit values of mineral commodities produced in Tennessee, 1945–49 (average) and 1950–54 [1]

Commodity	1945–49 (average)	1950	1951	1952	1953	1954
Barite, short ton	(2)	$10.44	$12.82	$12.95	$14.55	(2)
Cement, portland, 376-pound barrel	$1.91	2.20	2.40	2.40	2.51	$2.61
Clays:						
Ball, short ton	10.96	12.09	9.18	12.98	12.52	12.84
Fire, do	5.06	8.88	9.51	9.57	11.36	11.36
Fuller's earth, do	(2)	14.90	14.19	13.81	13.82	16.33
Miscellaneous, do	.83	.72	1.00	1.00	.96	.85
Coal, do	4.60	5.40	4.99	4.85	4.60	3.96
Copper, pound	.18	.21	.24	.24	.29	.30
Granite, crushed, short ton					1.20	(2)
Iron ore, long ton			3.97	5.91	6.47	(2)
Lead, pound	.13	.14	.17	.16	.13	.14
Lime, short ton	8.14	9.75	10.08	10.03	10.29	(2)
Limestone:						
Crushed, do	1.20	1.27	1.27	1.25	1.24	1.23
Dimension, do	(2)	.97	.77	1.84	.79	.94
Manganese ore, do	(2)	(2)		(2)	76.91	77.81
Marble:						
Crushed, do	4.16	5.45	6.78	7.50	5.57	10.15
Dimension, do	87.96	79.72	90.10	90.13	110.51	110.36
Natural gas, thousand cubic feet	(2)	.10	.09	.10	.12	(2)
Phosphate rock [3], long ton	5.68	7.24	7.47	7.49	7.55	7.19
Sand, short ton	(2)	1.31	1.37	1.25	1.26	1.35
Gravel, do	(2)	.85	.89	.81	.89	1.07
Sandstone:						
Crushed, do	(2)				[4] 5.84	14.36
Dimension, do	(2)	20.86	19.10	18.10	21.82	24.38
Stone: Miscellaneous, crushed, do				1.50		
Zinc, pound	.12	.14	.18	.17	.11	.11

[1] For greater detail on prices by grades and markets, see vol. 1, Minerals Yearbook, 1954.
[2] Figure withheld to avoid disclosure of individual company operations.
[3] Sold or used by producers.
[4] Refractory.

REVIEW BY MINERAL COMMODITIES

METALS

Copper.—The Tennessee Copper Co. recovered copper concentrates from sulfide ores mined in Polk County and produced blister copper at its smelter at Copperhill.

Gold.—Gold was recovered as a byproduct from copper and zinc concentrates.

Iron Ore.—The Monroe Mining Co. mined brown iron ore in Monroe County. The Rockwood Mining Co. opened a new mine in Roane County and produced red iron ore from the Clinton ore beds. The iron ore mined was used at Rockwood for making pig iron. Production increased considerably over 1953.

Manganese Ore.—Metallurgical grade (plus-35-percent Mn) manganese ore was mined by 10 producers in Johnson, Monroe, and Unicoi

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Counties. The largest producers were Tennessee Manganese Co. in Unicoi County, Ore Processing Corp. of Virginia, and Estelle Mining Co. in Johnson County. Shipments were 11,800 tons, compared with 2,600 tons in 1953.

Pyrite.—Tennessee Copper Co. recovered pyrite concentrate from sulfide ores at its mines in Polk County; production increased 5 percent over 1953. The pyrite concentrate was roasted, and the recovered gases were used in manufacturing sulfuric acid. The iron oxide sinter was sold to the iron-ore trade.

Silver.—The Tennessee Copper Co. recovered silver as a byproduct from smelting copper and zinc concentrates produced in Polk County.

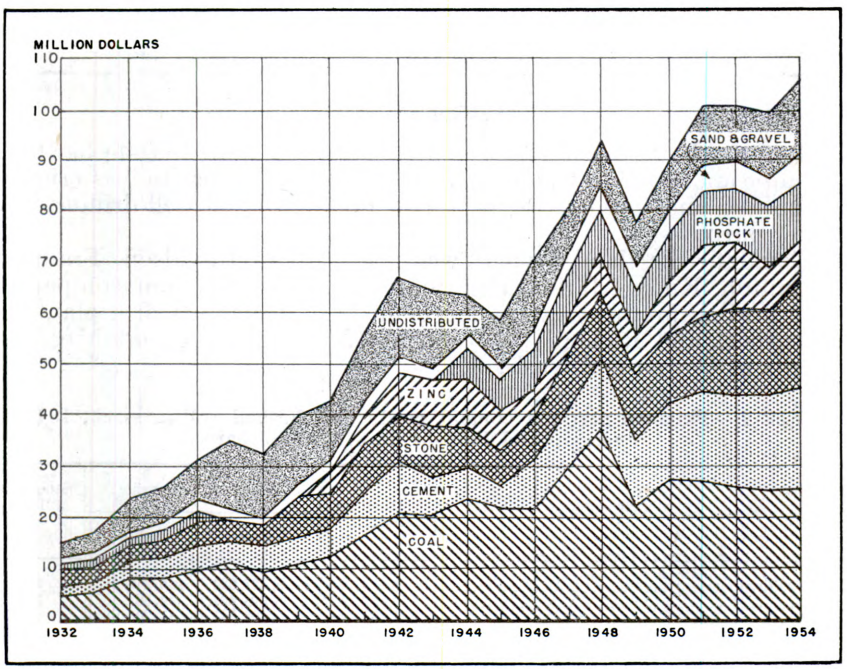

FIGURE 1.—Value of mineral production in Tennessee, 1932–54.

Zinc.—The American Zinc Co. of Tennessee and the Tennessee Coal & Iron Division of United States Steel Corp. recovered zinc from zinc ores mined in Jefferson and Knox Counties, and the Tennessee Copper Co. recovered zinc from copper-zinc ores produced in Polk County. The New Jersey Zinc Co. was developing a new zinc mine in Jefferson County.

The Defense Minerals Exploration Administration executed a contract with the American Zinc Co. of Tennessee for zinc exploration in Jefferson and Knox Counties, amounting to $1,017,000, with 50-percent Government participation.

A review of all available production data indicates that since 1850, 79.6 million crude tons of copper, lead, and zinc ores has been mined, of which 12.3 million tons was direct-smelting ores. The remaining 67.3 million tons yielded 3.4 million tons of copper, lead, and zinc concentrates. Smelting of the ores and concentrates is estimated to have yielded 22,600 troy ounces of gold, 3.5 million ounces of silver,

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444,000 tons of copper, 16,000 tons of lead, and 1.1 million tons of zinc aggregating $359.5 million in value.

TABLE 3.—Mine production of recoverable gold, silver, copper, lead, and zinc, 1945–49 (average) and 1950–54

Year	Gold		Silver		Copper		Lead		Zinc		Total value
	Fine ounces	Value	Fine ounces	Value	Short tons	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	175	$6,111	42,816	$37,027	6,791	$2,493,999	91	$24,817	29,792	$7,315,889	$9,877,843
1950	160	5,600	39,958	36,164	6,851	2,850,016	113	30,510	35,326	10,032,584	12,954,874
1951	108	3,780	24,960	22,590	7,069	3,421,396	14	4,844	38,639	14,064,596	17,517,206
1952	241	8,435	57,569	52,103	7,620	3,688,080	18	5,796	38,020	12,622,640	16,377,054
1953	293	10,255	68,935	62,390	7,829	4,493,846	9	2,358	38,465	8,846,950	13,415,807
1954	218	7,630	60,759	54,990	9,087	5,361,330	-----	-------	30,326	6,550,416	11,974,366

NONMETALS

Barite.—L. A. Wood, Inc., and B. C. Wood mined crude barite in Monroe and Loudon Counties, respectively. The barite was crushed or ground and sold for use in glass manufacture, oil-well drilling, and other purposes.

Cement.—Portland cement was produced in Davidson, Franklin, Hamilton, Knox, Marion, and Sullivan Counties by four companies. The leading producers were the Penn-Dixie Cement Corp. plants at Kingsport and Richard City and the Marquette Cement Mfg. Co. plants at Cowan and Nashville.

TABLE 4.—Finished portland cement produced, shipped and in stock, 1945–49 (average) and 1950–54, in 376-pound barrels

Year	Production, barrels	Shipment from mills		Stocks at mills on Dec. 31
		Barrels	Value	
1945–49 (average)	5,361,040	5,427,924	$10,319,559	368,468
1950	6,684,644	6,663,427	14,682,487	317,894
1951	7,221,968	7,162,841	17,203,080	377,021
1952	7,439,873	7,428,604	17,834,060	388,290
1953	7,474,604	7,276,964	18,283,366	585,930
1954	7,523,507	7,569,279	19,734,262	540,158

Clays.—Six companies mined ball clay in Carroll, Henry, and Weakley Counties. The leading producers were the H. C. Spinks Clay Co. mines in Henry and Weakley Counties and the United Clay Mines Corp. operation in Weakley County. Ball clay was used for whiteware, art pottery, high-grade tile, kiln furniture, firebrick and block, heavy clay products, enameling, miscellaneous filler, and other purposes.

Fire clay mined by B. Mifflin-Hood Co. in Hamilton County and by W. S. Dickey Clay Mfg. Co. in Rhea County was used in architectural terra cotta and heavy clay products.

The Southern Clay Co. and the Tennessee Absorbent Clay Co. mined fuller's earth in Henry County for absorbent uses.

Twelve companies mined miscellaneous clay in nine counties. The largest producers were the General Shale Products Corp., Knox, Sullivan, and Washington Counties; W. G. Bush & Co. Inc., Davidson County; and the Marquette Cement Mfg. Co., Davidson and Franklin

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Counties. Miscellaneous clay was used for cement manufacture, high-grade tile, architectural terra cotta, firebrick and block, and heavy clay products.

TABLE 5.—Clays sold or used by producers, 1945–49 (average) and 1950–54

	Ball clay		Fire clay		Fuller's earth		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	133,365	$1,440,660	28,618	$144,844	(1)	(1)	[1] 679,813	[1] $557,184	841,796	$2,142,688
1950	184,434	2,230,526	20,574	182,692	(1)	(1)	[1] 877,659	[1] 634,652	1,082,667	3,047,870
1951	194,191	1,782,642	23,759	226,009	(1)	(1)	[1] 942,621	[1] 1,287,844	1,160,571	3,296,495
1952	163,862	2,127,274	21,290	203,845	25,974	$358,752	831,113	829,272	1,042,239	3,519,143
1953	165,822	2,075,882	(2)	(2)	30,961	427,933	(2)	(2)	1,037,450	3,478,622
1954	194,072	2,491,229	15,437	175,364	27,532	449,480	742,720	629,384	979,761	3,745,457

[1] Fuller's earth included with miscellaneous clay.
[2] Figure withheld to avoid disclosure of individual company operations.

Lime.—Knoxville Lime Mfg. Co., Standard Lime & Stone Co., and Williams Lime Mfg. Co. produced lime in Knox County for building, agricultural, chemical, and industrial uses.

TABLE 6.—Lime sold or used by producers, 1945–49 (average) and 1950–54

Year	Quick		Hydrated		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	119,371	$910,861	46,523	$427,245	165,894	$1,338,106
1950	69,633	620,731	28,599	337,594	98,232	958,325
1951	86,776	817,419	22,194	280,455	108,970	1,097,874
1952	80,463	791,198	19,726	214,037	100,189	1,005,235
1953	(1)	(1)	(1)	(1)	114,474	1,177,461
1954	59,805	(1)	20,567	(1)	80,372	968,078

[1] Figure withheld to avoid disclosure of individual company operations.

Perlite (Expanded).—A plant in Nashville, using crude perlite shipped from Western States, produced expanded perlite used mainly as a lightweight aggregate, replacing heavier materials in plaster and concrete.

Phosphate Rock.—Blue, brown, and white phosphate rock was mined by 18 operators in 6 counties. The leading producers were Monsanto Chemical Co., Giles, Maury, and Williamson Counties; International Minerals & Chemical Corp., Giles and Maury Counties; and Virginia-Carolina Chemical Co., Maury County.

TABLE 7.—Marketable production of phosphate rock, 1945–49 (average) and 1950–54

Year	Long tons	Value [1]	Year	Long tons	Value [1]
1945–49 (average) [2]	1,393,990	$7,997,082	1952	1,444,737	$11,306,438
1950	1,472,017	10,739,635	1953	1,518,912	11,305,098
1951	1,424,516	10,798,406	1954	1,633,226	11,743,012

[1] Estimated from value of sold or used.
[2] Includes small quantity of apatite from Virginia, 1945–47.

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TABLE 8.—Phosphate rock sold or used by producers, 1953–54, by uses

Use	1953		1954	
	Long tons	Value [1]	Long tons	Value [1]
Elemental phosphorus	1,197,417	$9,254,796	1,333,158	$9,500,011
Direct application to the soil	191,440	1,234,808	166,829	1,262,054
Ordinary superphosphate	79,844	602,822	77,113	568,660
Other fertilizers	54,876	414,314	45,942	243,126
Triple superphosphate	62,376	470,939	40,832	216,410
Stock and poultry feed	21,365	161,306	18,617	134,410
Fertilizer filler	13,157	99,335	13,764	60,264
Other uses	1,695	12,797	4,317	27,379
Total	1,622,170	12,251,117	1,700,572	12,012,314

[1] Estimated.

Sand and Gravel.—Thirty-eight companies mined sand and gravel in 24 counties. Leading producers were: Marquette Cement Mfg. Co., Shelby County; Knoxville Sangravl Material Co., Knox County; and Cumberland River Sand & Gravel Co., Davidson County.

TABLE 9.—Sand and gravel sold or used by producers, 1945–49 (average) and 1950–54

Year	Sand		Gravel		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	(1)	(1)	(1)	(1)	3,774,733	$3,643,768
1950	1,938,970	$2,535,322	2,213,714	$1,875,783	4,152,684	4,411,105
1951	2,191,729	3,002,192	2,453,312	2,184,426	4,645,041	5,186,617
1952	2,531,528	3,156,770	2,641,873	2,146,551	5,173,401	5,303,321
1953	2,603,874	3,288,086	2,627,455	2,341,601	5,231,329	5,629,687
1954	2,191,599	2,962,012	2,963,586	3,179,127	5,155,185	6,141,139

[1] Figure withheld to avoid disclosure of individual company operations.

TABLE 10.—Sand and gravel sold or used by producers, 1953–54, by uses

Use	1953		1954	
	Short tons	Value	Short tons	Value
Sand:				
Structural	1,006,132	$1,235,398	1,000,757	$1,327,130
Paving	1,095,188	964,589	843,991	787,407
Molding	386,657	852,117	247,094	651,280
Glass	(1)	(1)	28,675	78,026
Furnace	(1)	(1)	4,120	10,280
Other	115,897	235,982	66,962	107,889
Gravel:				
Paving	1,325,875	832,260	1,364,753	1,142,316
Structural	1,052,255	1,294,037	1,156,895	1,585,434
Other	249,325	215,304	441,938	451,377
Total	5,231,329	5,629,687	5,155,185	6,141,139

[1] Figure withheld to avoid disclosure of individual company operations. Included with "Other."

Stone.—The Blue Ridge Stone Co. produced crushed granite for concrete and roads in Carter County. Production was 42,000 tons valued at $52,500.

Crushed limestone was produced by 81 operators in 53 counties. The leading producers were: Franklin Limestone Co., Davidson,

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Humphreys, and Williamson Counties; Lambert Bros., Inc., Davidson, De Kalb, Hawkins, Knox, Loudon, and Sevier Counties; and American Zinc Co. of Tennessee, Jefferson, and Knox Counties.

The Davidson County Highway Department, Avondale Stone Co. (Hamilton County), and Posey & Caldwell (Meigs County), quarried a small quantity of dimension limestone.

Six companies produced crushed marble in three counties. Leading producers were John J. Craig Co., Blount County, and Appalachian Marble Co., Knox County.

Six companies quarried dimension marble in three counties. Leading producers were Gray Knox Marble Co., Blount and Knox Counties, and Tennessee Marble, Inc., Knox and Union Counties.

Four operators produced crushed sandstone, in three counties. The leading producer was the Turner Bros. Stone Co., Cumberland County.

Twelve companies quarried dimension sandstone in four counties. Leading producers were the Crab Orchard Stone Co., Inc., the Tennessee Stone Co., Inc., and the Turner Bros. Stone Co., with quarries in Cumberland County.

TABLE 11.—Crushed and broken stone sold or used by producers, 1945–49 (average) and 1950–54

Year	Limestone [1]		Marble		Sandstone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	6,369,544	$7,662,468	20,978	$84,763	(2)	(2)	[3] 6,390,522	[3] $7,747,231
1950	7,880,040	9,971,731	20,620	112,317			7,900,660	10,084,048
1951	8,778,055	11,176,605	21,444	145,438			8,799,499	11,322,043
1952	10,250,723	12,790,302	15,381	115,424			10,266,104	12,905,726
1953	10,373,162	12,870,198	31,142	173,398	1,222	$7,132	[3] 10,405,504	[3] 13,050,728
1954	13,878,172	17,090,152	17,620	178,789	4,496	64,544	[3] 13,900,288	[3] 17,333,485

[1] Except limestone for cement or lime, 1945–53.
[2] Figure withheld to avoid disclosure of individual company operations.
[3] Incomplete total; excludes sandstone, 1945–49 and 1954, and granite, 1953–54.

TABLE 12.—Crushed limestone sold or used by producers, 1953–54, by uses

Use	1953 [1]		1954	
	Short tons	Value	Short tons	Value
Concrete and roads	8,549,948	$10,543,058	9,874,148	$12,468,238
Cement and lime	(2)	(2)	2,214,678	2,374,532
Agriculture	712,004	918,100	698,057	918,947
Railroad ballast	723,232	720,456	543,602	508,364
Asphalt filler	3,854	5,395	135,439	170,195
Fluxing stone	(2)	(2)	34,150	48,124
Riprap	(2)	(2)	31,965	25,259
Glass manufacture	(2)	(2)	23,278	43,581
Mineral food	(2)	(2)	19,200	77,000
Other uses	384,124	683,189	303,655	455,912
Total	10,373,162	12,870,198	13,878,172	17,090,152

[1] Except for cement and lime.
[2] Not canvassed.
[3] Figure withheld to avoid disclosure of individual company operations.

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TABLE 13.—Dimension stone sold or used by producers, 1945–49 (average) and 1950–54

Year	Limestone		Marble		Sandstone		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	(1)	(1)	22,960	$1,997,455	(1)	(1)	(1)	(1)
1950	3,710	$3,604	36,800	2,933,878	37,420	$780,758	77,930	$3,718,240
1951	1,082	835	38,215	3,443,110	(1)	(1)	(1)	(1)
1952	3,226	5,926	42,940	3,870,006	46,769	846,684	92,935	4,722,616
1953	2,214	1,739	24,826	2,743,733	52,785	1,151,853	79,825	3,897,325
1954	4,292	4,015	27,611	3,047,135	65,996	1,608,881	97,899	4,660,031

[1] Figure withheld to avoid disclosure of individual company operations.

TABLE 14.—Dimension marble sold or used by producers, 1953–54, by uses

Use	1953		1954	
	Cubic feet	Value	Cubic feet	Value
Building:				
Interior, cut, dressed	117,803	$1,970,683	108,060	$2,002,341
Exterior, rough	(1)	(1)	113,196	456,365
Interior, sawed, dressed	28,170	217,467	28,603	237,486
Exterior, sawed, dressed	(1)	(1)	31,436	211,728
Interior, rough	85,966	260,949	(1)	(1)
Monumental: Cut, dressed	3,754	56,922	(1)	(1)
Other uses	56,377	237,712	43,444	139,215
Total	292,070	2,743,733	324,840	3,047,135

[1] Figure withheld to avoid disclosure of individual company operations. Included with "Other uses."

MINERAL FUELS

Coal.—Coal was mined in 19 counties; Marion, Campbell, and Anderson Counties were the largest producers. Output increased significantly in 1954 and exceeded 6 million tons for the first year since 1947.

TABLE 15.—Production of coal, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	5,760,569	$26,404,060	1953	5,466,569	$25,151,682
1950	5,069,800	27,360,273	1954	6,428,831	25,477,006
1951	5,400,946	26,956,174			
1952	5,264,954	25,559,740	Total production, earliest records to date	353,115,000	(1)

[1] Data not available.

Natural Gas.—Production of natural gas (89 million cubic feet) was the same as in 1953.

Petroleum.—Thirteen thousand barrels of crude petroleum was produced valued at $27,000.

REVIEW BY COUNTIES

Anderson.—Coal production was about the same as in 1953. The Anderson County Highway Department (Dail No. 2 and Taylor No. 1 quarries) and Ralph Rogers & Co., Inc. (Rogers quarry), crushed

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limestone for concrete and roads; production increased 80 percent over 1953.

Bedford.—The Bedford County Highway Department and the Shelbyville Limestone Co. crushed limestone for concrete and roads and for agricultural purposes; production was 264,500 tons valued at $299,000, compared with 47,900 tons valued at $38,300 in 1953.

Benton.—The Camden Gravel Co., C. M. Hardy, Hardy Sand Co., Hicks Sand Co., Kimballs Mineral Supplies, Inc., and Porter-Warner Industries, Inc., mined furnace, molding, and other sand, and paving sand and gravel.

TABLE 16.—Value of mineral production in Tennessee, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value [2]
Anderson	$3,899,750	$2,115,000	Coal, limestone.
Bedford	38,324	299,049	Limestone.
Benton	490,348	518,719	Sand and gravel.
Bledsoe	181,465	69,000	Coal.
Blount	835,893	(3)	Marble, limestone.
Bradley	(3)	90,720	Limestone.
Campbell	5,091,428	3,733,000	Coal, sand and gravel.
Cannon	(3)	(3)	Limestone.
Carroll		(3)	Ball clay.
Carter	(3)	(3)	Limestone, granite.
Cheatham	(3)		
Claiborne	2,855,633	1,503,000	Coal.
Cocke	48,313	(3)	Limestone, sandstone.
Coffee	(3)	(3)	Limestone.
Cumberland	123,000	375,000	Sandstone, limestone, coal.
Davidson	4,344,057	(3)	Cement, limestone, sand and gravel, miscellaneous clay, phosphate rock.
Decatur	21,000	(3)	Sand and gravel.
DeKalb	25,526	65,656	Limestone.
Dickson		(3)	Do.
Fayette	6,607	7	Sand and gravel.
Fentress	781,604	226,000	Coal, sandstone, limestone.
Franklin	(3)	(3)	Cement, limestone, sand and gravel, miscellaneous clay.
Giles	1,463,393	(3)	Phosphate rock, limestone, sand and gravel.
Grainger	42,528	49,176	Limestone.
Greene	(3)	(3)	Do.
Grundy	913,363	1,860,000	Coal.
Hamilton	201,000	301,000	Cement, limestone, coal, sand and gravel, miscellaneous clay, fire clay.
Hancock	(3)	7,200	Limestone.
Hardeman		(3)	Sand and gravel.
Hawkins	60,000	654,682	Limestone.
Haywood	8,635	12,708	Sand and gravel.
Henderson	(3)	(3)	Do.
Henry	(3)	(3)	Ball clay, fuller's earth.
Hickman	(3)	(3)	Phosphate rock.
Humphreys	714,659	(3)	Limestone, sand and gravel.
Jefferson	(3)	(3)	Zinc, limestone.
Johnson	341,251	(3)	Manganese ore, limestone.
Knox	12,918,766	12,510,565	Cement, zinc, limestone, marble, lime, sand and gravel, miscellaneous clay.
Lake	119,397		
Lauderdale	104,005	4,179	Sand and gravel.
Lincoln		(3)	Limestone.
Loudon	(3)	(3)	Barite, sand and gravel, miscellaneous clay, limestone.
Macon	(3)	(3)	Limestone.
Marion	9,852,630	6,804,000	Coal, cement, limestone.
Marshall	(3)	(3)	Limestone.
Maury	(3)	(3)	Phosphate rock, limestone.
McMinn	226,750	214,317	Limestone.
McNairy	(3)	(3)	Sand and gravel.
Meigs	(3)	(3)	Limestone.
Monroe	(3)	(3)	Barite, limestone, iron ore, manganese ore.
Montgomery	297,311	(3)	Limestone.
Morgan	1,592,911	(3)	Coal, sandstone.
Obion	42,928	46,497	Sand and gravel.
Overton	486,000	84,000	Coal, limestone.
Perry	(3)	(3)	Phosphate rock, limestone.
Pickett	45,940		Coal.
Polk	(3)	(3)	Copper, pyrite, zinc, limestone, silver, gold.
Putnam	1,679,000	3,144,000	Coal, limestone.
Rhea	32,000	180,000	Fire clay, limestone, miscellaneous clay, coal.

See footnotes at end of table.

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TABLE 16.—Value of mineral production in Tennessee, 1953–54, by counties [1]—Continued

County	1953	1954	Minerals produced in 1954 in order of value [2]
Roane	(3)	(3)	Limestone, iron ore, coal.
Robertson	$208,125	$356,322	Limestone.
Rutherford	(3)	(3)	Do.
Scott	1,230,925	1,794,000	Coal.
Sequatchie	370,494	811,000	Coal, limestone.
Sevier	(3)	(3)	Limestone, sandstone.
Shelby	1,031,574	(3)	Sand and gravel, miscellaneous clays.
Smith		(3)	Limestone.
Sullivan	3,722,828	(3)	Cement, limestone miscellaneous clay, sand and gravel.
Sumner	(3)	(3)	Limestone, sand and gravel.
Tipton	552,773	(3)	Sand and gravel.
Unicoi	(3)	(3)	Manganese, sand and gravel, limestone.
Union	54,000	(3)	Marble.
Van Buren	414,000	95,000	Coal, limestone.
Warren	(3)	(3)	Limestone.
Washington	(3)	(3)	Miscellaneous clay.
Wayne	(3)	(3)	Sand and gravel.
Weakley	(3)	(3)	Ball clay.
White	82,000	55,000	Limestone, coal, sandstone.
Williamson	(3)	(3)	Phosphate rock, limestone, sand and gravel.
Wilson	(3)	(3)	Limestone.
Undistributed	40,497,866	67,707,203	
Total	98,050,000	105,686,000	

[1] The following counties are not listed because no production was reported: Chester, Clay, Crockett, Dyer, Gibson, Hamblen, Hardin, Houston, Jackson, Lawrence, Lewis, Madison, Moore, Stewart, and Trousdale.
[2] Barite (1953), coal (in certain counties), manganese ore (1953), natural gas, and petroleum included with "Undistributed."
[3] Figure withheld to avoid disclosure of individual company operations.

TABLE 17.—Sand and gravel sold or used by producers in Benton County, 1950–54

Year	Short tons	Value	Year	Short tons	Value
1950	372,173	$490,954	1953	(1)	$490,348
1951	357,986	561,738	1954	280,312	518,719
1952	357,901	564,976			

[1] Figure withheld to avoid disclosure of individual company operations.

Bledsoe.—Coal production was considerably less than in 1953.

Blount.—Sam Lambert & Sons crushed limestone for concrete and roads, agstone, and other uses; production was 150,000 tons valued at $211,800, compared with 238,000 tons valued at $302,000 in 1953. John J. Craig Co. (Crisp, Hamil, Lee, and Marmor quarries), Gray Knox Marble Co. (Brown and French Pink quarries), and Friendsville Marble Co., Inc. (Endsley quarry), produced crushed and dimension marble for rough building stone, dressed building stone, cut and dressed monumental stone, terrazzo, and other uses.

Bradley.—The Bradley County Highway Department (Rubin Moore quarry) crushed limestone for concrete and roads; production was 72,000 tons valued at $90,700.

Campbell.—Coal production increased considerably over that in 1953. Silica Sand Co., Inc., mined grinding and polishing and other sand; production was 43,400 tons valued at $73,300, compared with 72,300 tons valued at $60,000 in 1953.

Cannon.—S. N. McPherson (Norvell quarry) crushed limestone for concrete and roads; production was nearly three times that in 1953.

Carroll.—Kentucky-Tennessee Clay Co. mined ball clay for firebrick and block, high-grade tile, kiln furniture, and other uses.

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Carter.—Blue Ridge Stone Co. crushed granite for concrete and roads; production was 42,000 tons valued at $52,500. Wautauga Stone Co. crushed limestone for agstone, concrete and roads, and railroad ballast; production decreased 27 percent below 1953.

Claiborne.—Coal production was about the same as in 1953.

Cocke.—The Cocke County Highway Department (Briar Thicket and Burnett quarries) crushed limestone for concrete and roads; production was 24,100 tons valued at $27,000, compared with 31,800 tons valued at $48,300 in 1953. Haskill Finchum crushed sandstone for concrete and roads.

Coffee.—D. & D. Rock & Lime Co. (Summitville quarry) crushed limestone for concrete and roads.

Cumberland.—Coal production increased considerably over 1953. The Cumberland County Highway Department and Southern States Lime Mfg. Co. (Crab Orchard quarry) crushed limestone for agstone, blast-furnace flux, concrete and roads, glass manufacture, mineral food, paper filler, and railroad ballast; production was 108,000 tons valued at $184,400. Crab Orchard Stone Co., Inc. (Peck quarry), Crossville Stone Co., Hembree Stone Co., Dock Hinch, Jr., Monday & Manning, James E. Roberts, Tennessee Stone Co., Inc. (McGuire quarry), and Turner Bros. Stone Co., Inc., produced crushed and dimension sandstone for refractory purposes, riprap, rough architectural and dressed building stone, and flagging; production of dimension stone was 55,000 tons valued at $1,387,000, compared with 52,800 tons valued at $1,151,900 in 1953.

Davidson.—Marquette Cement Mfg. Co. operated its Nashville mill throughout the year; shipments of portland cement increased 8 percent over 1953. W. G. Bush & Co., Inc., and Marquette Cement Mfg. Co. mined miscellaneous clay for cement and heavy clay products. The Davidson County Highway Department, Eller & Olson Crushed Stone Co., Inc., Franklin Limestone Co. (Danley and Old Hickory quarries), and Lambert Bros., Inc., crushed limestone for agriculture, asphalt filler, concrete and roads, mineral food, railroad ballast, riprap, rock dust for coal mines, whiting, and other uses; production was 1,244,000 tons valued at $1,329,000. The Davidson County Highway Department quarried 1,500 tons of building stone valued at $1,200, compared with 1,800 tons valued at $1,300 in 1953. Tennessee Products & Chemical Corp. (Nashville plant) produced expanded perlite from crude material mined in other States. Harsh Phosphate Co. mined brown phosphate rock for fertilizer filler; marketable production increased 2 percent over 1953. Cumberland River Sand & Gravel Co. and T. L. Herbert & Sons mined blast, engine, furnace, glass and molding sand, and structural and paving sand and gravel; production increased 79 percent over 1953.

Decatur.—Tinker Sand & Gravel Co. mined structural sand and gravel.

De Kalb.—The De Kalb County Highway Department (Sligo quarry) and Lambert Bros., Inc. (Liberty quarry), crushed limestone for concrete and roads; production was 52,600 tons valued at $65,700, compared with 23,200 tons valued at $25,500 in 1953.

Dickson.—Duke Lime & Stone Co. crushed limestone for concrete and roads and for agriculture.

Fayette.—The Fayette County Highway Department mined a small quantity of paving sand.

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Fentress.—Coal production increased considerably over that in 1953. Frogge & Williams, Inc. (Reagan and Wright quarries), crushed limestone for concrete and roads, and for agricultural uses; production was 114,100 tons valued at $134,200, compared with 143,500 tons valued at $179,400 in 1953. Clarkrange Stone Co. quarried dimension sandstone for use as rough architectural and dressed building stone and as flagging.

Franklin.—Marquette Cement Mfg. Co. operated the Cowan mill throughout the year; shipments of portland cement increased 16 percent over 1953. Marquette Cement Mfg. Co. mined miscellaneous clay for cement. Cowan Stone Co. (Anderson and Cowan quarries) and the Franklin County Highway Department crushed limestone for agstone, cement, concrete and roads, blast-furnace flux, glass manufacture, railroad ballast, and other uses. Estill Springs Sand-Gravel Co., Sewannee Silica Sand Co., and H. Y. Thompson mined blast, engine, filter, furnace, glass, and molding sand, and structural sand and gravel; production declined 20 percent below 1953.

Giles.—Cedar Grove Lime Co. crushed limestone for concrete and roads. International Minerals & Chemical Corp. (Wales mine) and Monsanto Chemical Co. mined brown phosphate rock for direct application to the soil, blast-furnace use, elemental phosphorus, and stock and poultry feed. The Giles County Highway Department mined 168,800 tons of paving gravel, compared with 52,900 tons in 1953.

Grainger.—The Grainger County Highway Department (Capps and Mitchell quarries) crushed limestone for concrete and roads; production was 31,700 tons valued at $49,200, compared with 33,200 tons valued at $42,500 in 1953.

Greene.—Agricultural Lime Co., Inc., the Greene County Highway Department (Ratcliffe quarry), and Malone Bros. crushed limestone for agstone, concrete and roads, and other uses; production decreased 1 percent below 1953.

Grundy.—Coal production declined slightly below that in 1953.

Hamilton.—General Portland Cement Co. operated the Signal Mountain mill throughout the year; shipments of portland cement increased 24 percent over 1953. B. Mifflin-Hood Co. mined fire clay for architectural terra cotta. General Portland Cement Co., Key-James Brick Co., and B. Mifflin-Hood Co. mined miscellaneous clay for architectural terra cotta, cement, heavy clay products, and high-grade tile; production was 108,700 tons valued at $85,200. Coal production increased considerably over that in 1953. Avondale Stone Co., Chattanooga Rock Products Co., and General Portland Cement Co. crushed limestone for alkali, agstone, cement, concrete and roads, railroad ballast, and riprap; Avondale Stone Co. quarried 785 tons of dimension limestone for rubble valued at $785, compared with 425 tons valued at $425 in 1953. Dixie Sand & Gravel Co. mined structural and paving sand and gravel.

Hancock.—The Tennessee State Highway Department (Trent's quarry) crushed limestone for concrete and roads.

Hardeman.—Saulsbury Sand Co. mined molding, structural, and paving sands.

Hawkins.—The Hawkins County Highway Department and Lambert Bros., Inc. (McCloud quarry), crushed limestone for concrete and roads; production was 440,700 tons valued at $654,700, compared with 25,000 tons valued at $60,000 in 1953.

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Haywood.—The Haywood County Highway Department mined 79,900 tons of paving gravel, compared with 97,100 tons in 1953.

Henderson.—Ayers Mineral Co. mined molding sand; production declined 3 percent below that in 1953.

Henry.—Dixie Brick & Tile Co. (Puryear mine), Kentucky–Tennessee Clay Co., and H. C. Spinks Clay Co. (Como, Henry, and Puryear mines) mined ball clay for firebrick and block, heavy clay products, high-grade tile, kiln furniture, whiteware, and other uses; production declined 29 percent below 1953. Southern Clay Co., Inc. (Porter Creek Mine), and Tennessee Absorbent Clay Co. (Paris mine) mined fuller's earth for use as an absorbent in oil clarification; production was 27,500 tons valued at $449,500, compared with 31,000 tons valued at $427,900 in 1953.

Hickman.—M. C. Boyle Phosphate Co. (Dean's Switch mine), Highland Mining Co., Owens Agricultural Phosphate Corp., and Phosphate Mining Co. mined brown phosphate rock for direct application to the soil and for elemental phosphorus; marketable production increased 26 percent over that in 1953.

Humphreys.—Franklin Limestone Co. (Rock Hill quarry) crushed limestone for agriculture, concrete and roads, and railroad ballast and riprap; production increased 2 percent over 1953. Sangravl Co., Inc., mined railroad-ballast gravel and structural and paving sand and gravel; production declined 30 percent below that in 1953.

Jefferson.—The American Zinc Co. of Tennessee and Tennessee Coal & Iron Division of United States Steel Corp. recovered crushed limestone as a byproduct from zinc mining for agstone, concrete and roads, railroad ballast, and other uses. American Zinc Co. of Tennessee (Athletic and North Friends Station mines) and Tennessee Coal & Iron Division of United States Steel Corp. (Davis–Bible mine) recovered zinc from zinc ores; production declined 44 percent below 1953 because the Grasselli and Jarnagin mines closed.

Johnson.—Maymead Lime Co. crushed limestone for agricultural use and for concrete and roads; production declined 2 percent below that in 1953. Estelle Mining Co. (Laurel Bloomery and Estelle mines), Ore Processing Corp. of Virginia (Brettler and Davis mines), Stewart & Seeman, Valley Mining Co. Ltd. (King mine), and H. I. Weiner mined metallurgical-grade manganese ore; production more than doubled that of 1953.

Knox.—Volunteer Portland Cement Co. operated the Knoxville mill throughout the year; shipments of portland cement declined 5 percent below 1953. Cherokee Shale Brick Co., General Shale Products Corp., and Volunteer Portland Cement Co. mined miscellaneous clay for cement and heavy clay products. Knoxville Lime Manufacturing Co., Standard Lime & Cement Co., and Williams Lime Mfg. Co. produced 80,400 tons of lime, compared with 114,500 tons in 1953. The American Zinc Co. of Tennessee recovered crushed limestone as a byproduct from zinc mining; American Limestone Co. (Holston and Midway quarries), Burkhart Quarry Supplies, Inc., Knox County Highway Department (Biagotti, Freeway, Kennedy, Neuberts, and Tecoa quarries), Knoxville Lime Mfg. Co., Oliver King Sand-Lime Co., Inc., Lambert Bros., Inc., Standard Lime & Cement Co., Volunteer Portland Cement Co., and Williams Lime Mfg. Co. produced crushed limestone. The limestone produced by these companies was employed for agstone, cement, concrete and roads, lime, paper filler, railroad ballast, and other uses. Appalachian

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Marble Co. (Appalachian and Bond Pink quarries), Gray Knox Marble Co., Knoxville Crushed Stone Co., and Tennessee Marble, Inc. (Eagle and Knox quarries), produced crushed marble for terrazzo and other uses and dimension marble for rough and dressed building stone and for cut and dressed monumental stone. Knoxville Sangravl Materials Co. and Oliver King Sand-Lime Co. mined engine and grinding sand and structural and paving sand and gravel; production increased 2 percent over that in 1953. The American Zinc Co. of Tennessee (Mascot No. 2 mine) recovered zinc from zinc ores; production increased 7 percent above that in 1953. S. W. Forney shipped a small quantity of oxidized zinc ore.

TABLE 18.—Crushed limestone sold or used by producers in Knox County, 1950–54

Year	Short tons	Value	Year	Short tons	Value
1950 [1]	1,254,340	$1,794,722	1953 [1]	1,291,678	$1,801,016
1951 [1]	(2)	1,830,596	1954	1,997,365	2,382,607
1952 [1]	1,725,685	2,251,609			

[1] Except for cement or lime.
[2] Figure withheld to avoid disclosure of individual company operations.

Lauderdale.—The Lauderdale County Highway Department mined 50,300 tons of paving gravel, compared with 174,100 tons in 1953.

Lincoln.—Clark & Stephenson and Foster & Wright crushed limestone for agstone and for concrete and roads.

Loudon.—B. C. Wood (Sandy mine) mined barite for well drilling and other uses. Old Hickory Brick Co. (Maryville mine) mined miscellaneous clay for firebrick and block, and for heavy clay products; production was 17,500 tons valued at $16,300, compared with 20,000 tons valued at $6,900 in 1953. Lambert Bros., Inc. (Greenback quarry), crushed a small quantity of limestone for concrete and roads. Brooks Sand & Gravel Co. mined paving sand and gravel; production was 42,200 tons valued at $59,200.

Macon.—Dixon & Stubblefield (Langford quarry) crushed limestone for concrete and roads; production increased 31 percent over that in 1953.

Marion.—Penn-Dixie Cement Corp. operated the Richard City mill throughout the year; shipments of portland cement decreased 5 percent below 1953. Coal production was considerably more than in 1953. Campbell Limestone Co. (Ketchall quarry) and the Penn-Dixie Cement Corp. crushed limestone for cement and for concrete and roads.

Marshall.—Lewisburg Limestone Co. crushed limestone for agriculture and for concrete and roads; production was considerably higher than in 1953.

Maury.—Columbia Rock Products Corp. (Theta Pike quarry) crushed limestone for agriculture, concrete and roads, and other uses; production was 281,500 tons valued at $331,700. Mine Equipment Co. and Marvin Pitts mined blue phosphate rock for elemental phosphorus and for blast-furnace use. Armour Fertilizer Works (McKennon mine), International Minerals & Chemical Corp. (Mount Pleasnant mine), Mine Equipment Co., Monsanto Chemical Co. (Monsanto mine), J. T. Prince, Tennessee Valley Authority, Victor Chemical Works, and Virginia-Carolina Chemical Corp. (Arrow mine) mined brown phosphate rock for blast furnaces, direct application to

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the soil, elemental phosphorus, fertilizer filler, stock and poultry feed, superphosphate, triple superphosphate, and other fertilizers.

McMinn.—The McMinn County Highway Department and Floyd D. Webb crushed limestone for agriculture and for concrete and roads; production was 174,200 tons valued at $214,300, compared with 170,000 tons valued at $226,800 in 1953.

McNairy.—Worsham Bros. mined glass sand and paving gravel; production was about the same as in 1953.

Meigs.—W. D. Carter and Posey & Caldwell produced crushed limestone for agriculture and for concrete and roads, and dimension limestone for rubble; production of crushed limestone increased 17 percent over 1953; rubble production was 2,000 tons valued at $2,000.

Monroe.—L. A. Wood, Inc. (Stephens & Ballard mine), mined barite for glass manufacture and for well drilling. Monroe Mining Co. (Lindermann mine) mined brown iron ore for blast-furnace use. The Monroe County Highway Department (Tallent quarry) crushed limestone for concrete and roads; production was 59,800 tons valued at $59,800, compared with 72,100 tons valued at $90,100 in 1953. Consolidated High Grade Ore Co. mined a small quantity of metallurgical-grade manganese ore at the Heiskell mine.

Montgomery.—Clarksville Stone Co. and Simpson Stone Co. crushed limestone for agriculture and for concrete and roads; production declined 4 percent below 1953.

Morgan.—Coal production was considerably larger than in 1953. Frogge & Williams, Inc., and Jones Stone Co. quarried dimension sandstone for rough architectural and dressed building stone.

Obion.—The Obion County Highway Commission mined 121,700 tons of paving gravel valued at $46,500, compared with 130,600 tons valued at $42,900 in 1953.

Overton.—Considerably more coal was produced than in 1953. Arnold Rock Co. crushed limestone for concrete and roads; production was considerably less than in 1953.

Perry.—Charlie Elkins crushed 46,400 tons of limestone valued at $93,400 for agricultural use and for concrete and roads. J. H. Patterson Mining Co., Perry County Phosphate Co., and V. P. Serodino mined white phosphate rock for use in making elemental phosphorus; marketable production was considerably more than in 1953.

Pickett.—Coal production was considerably less than in 1953.

Polk.—Tennessee Copper Co. (Boyd, Burra-Burra, Calloway-Mary, Eureka, and London Mines) mined sulfide ores which yielded copper, pyrite, and zinc concentrates; small quantities of gold and silver were recovered as byproducts from copper and zinc concentrates; production figures for copper, gold, and silver are shown in table 4; pyrite production increased 5 percent over 1953; and zinc production increased 16 percent over 1953. Campbell Lime & Stone Co. and Polk County Highway Department crushed limestone for agriculture and for concrete and roads; production increased 47 percent above 1953.

Putnam.—Coal production was considerably higher than in 1953. Algood Limestone Co. (Poteet quarry) crushed limestone for agriculture and for concrete and roads; production decreased 67 percent below 1953.

Rhea.—W. S. Dickey Clay Mfg. Co. mined fire clay for heavy clay products and 32,100 tons of miscellaneous clay valued at $29,800 for heavy clay products. Coal production more than doubled

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that of 1953. Dayton Coal & Iron Corp. and Wilbur Morton crushed limestone for concrete and roads; production was considerably higher than in 1953.

Roane.—The production of coal was resumed. Rockwood Mining Co. (New Chamberlain mine) mined red iron ore for blast-furnace use. A. B. Long Construction Co. (Swan Pond quarry) and Rockwood Slag Products Co. crushed limestone for agriculture, concrete and roads, and riprap; production decreased 39 percent below 1953.

Robertson.—Porter Brown Limestone Co. crushed limestone for agriculture and for concrete and roads; production was 285,000 tons valued at $356,300, compared with 166,500 tons valued at $208,100 in 1953.

Rutherford.—Bilbrey Rock Co. crushed limestone for concrete and roads and for other uses; production increased 14 percent over 1953.

Scott.—Coal production was considerably larger than in 1953.

Sequatchie.—Coal production nearly doubled that in 1953. Dunlap Stone Co. crushed 65,800 tons of limestone valued at $98,500 for agricultural uses and for concrete and roads.

Sevier.—Lambert Bros., Inc., crushed limestone for concrete and roads; production was considerably higher than in 1953. The United States Bureau of Public Roads crushed sandstone for concrete and roads; production was 700 tons valued at $4,500.

Shelby.—John A. Denie's Sons Co. mined miscellaneous clay for heavy clay products; production was considerably more than in 1953. Banks Bros., Inc., Cordova Sand & Gravel Co., R. P. Harris Gravel Co., Hollywood Sand & Gravel Co., Inc., Marquette Cement Mfg. Co., and Memphis Stone & Gravel Co. mined structural, paving, and other sand and gravel; production was 1,682,600 tons valued at $1,947,500.

Smith.—Oldham Limestone Co. crushed limestone for concrete and roads.

Sullivan.—Penn-Dixie Cement Corp. operated the Kingsport mill throughout the year; shipments of portland cement decreased 2 percent below 1953. General Shale Products Corp. (Kingsport mine) and Penn-Dixie Cement Corp. mined miscellaneous clay for cement and heavy clay products. Penn-Dixie Cement Corp., Standard Crushed Stone Co. (Holston and New Kingsport quarries), and Sullivan County Highway Department (Orebank, Rock Springs, and Walnut Hill quarries) crushed limestone for cement, concrete and roads, and railroad ballast; production was 820,800 tons valued at $994,500. Afton Good mined a small quantity of structural sand.

Sumner.—C. A. Langford and Pilot Knob Limestone Co. crushed limestone for concrete and roads; production decreased 1 percent below 1953. The Sumner County Highway Department mined 89,700 tons of paving gravel valued at $34,500, compared with 84,500 tons valued at $32,500 in 1953.

Tipton.—Owens Sand & Gravel Co. and Smiley Sand & Gravel Co. mined structural and paving sand and gravel.

Unicoi.—Standard Crushed Stone Co. (Okalona quarry) crushed limestone for concrete and roads; production was 246,000 tons valued at $296,800. Lewis Mining Co. and Tennessee Manganese Co. mined metallurgical-grade manganese ore. Brooks Sand & Gravel Co. mined railroad-ballast gravel and paving sand and gravel; production was 271,300 tons valued at $308,700.

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Union.—Tennessee Marble Co. (Luttrell quarry) produced crushed and dimension marble for rough and dressed building stone, cut and dressed monumental stone, and other uses.

Van Buren.—Coal production was less than half that in 1953. The Van Buren County Highway Department (Graham quarry) crushed 14,200 tons of limestone valued at $28,400 for concrete and roads.

Warren.—Warren Limestone Co. crushed limestone for concrete and roads; production decreased 47 percent below 1953.

Washington.—General Shale Products Corp. (Johnson City mine) mined miscellaneous clay for heavy clay products; production increased 15 percent above that in 1953.

Wayne.—Clifton Towing Co. (Baker mine) and the Federal Bureau of Public Roads mined structural gravel and structural and paving sand; production decreased 12 percent below 1953.

Weakley.—Bell Clay Co. (Collins mine), Cooley Clay Co. (Greenfield mine), Kentucky-Tennessee Clay Co., H. C. Spinks Clay Co., and United Clay Mines Corp. (No. 6 mine) mined ball clay for art pottery, enameling, firebrick and block, high-grade tile, kiln furniture, whiteware, and other uses; production increased 47 percent over that in 1953.

White.—Coal production was about the same as in 1953. Sparta Limestone Co., Thompson-Weinman & Co., Inc. (Sparta quarry), and the White County Highway Department crushed limestone for agricultural uses, asphalt filler, whiting, and other applications; the total value of material sold or used by producers was $307,900. White County Lumber Co. quarried a small quantity of dimension sandstone for rough architectural building stone.

Williamson.—Franklin Limestone Co. and Williamson County Highway Department crushed limestone for agriculture, asphalt filler, concrete and roads, railroad ballast, riprap, and other uses; production decreased 2 percent below that in 1953. Monsanto Chemical Co. mined brown phosphate rock for elemental phosphorus. The Williamson County Highway Department (Globe mine) mined 7,800 tons of paving gravel, compared with 11,600 tons in 1953.

Wilson.—Lebanon Limestone Co. and Marquette Cement Mfg. Co. (Martha quarry) crushed limestone for agstone, cement, concrete and roads, and railroad ballast.

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The Mineral Industry of Texas

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior and The University of Texas through the Bureau of Economic Geology.

By F. F. Netzeband[1] and John T. Lonsdale[2]

THE MINERAL industries of Texas maintained their important position in the industrial activities of the Southwest and of the Nation in 1954, with a total value of $3.7 billion, about one-fourth of the total 1954 domestic mineral value.

TABLE 1.—Mineral production in Texas, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Abrasive stone: Pebbles, grinding	400	$5,500	(2)	(2)
Cement—376-pound barrels	19,140,193	48,497,762	21,928,170	$56,674,124
Clays	2,370,975	4,678,974	2,400,924	7,002,024
Gypsum	1,067,854	2,860,633	1,218,048	3,773,230
Helium—cubic feet	103,711,334	1,388,671	110,588,471	1,873,860
Iron ore (usable)—long tons, gross weight	1,014,937	(2)	881,190	(2)
Lime (open-market)	475,569	4,380,831	547,436	5,421,731
Natural gas—million cubic feet	4,383,158	333,120,000	4,551,232	386,855,000
Natural-gas liquids:				
Natural gasoline and cycle products—thousand gallons	2,750,370	200,479,000	2,732,100	200,559,000
LP-gases—do	2,777,880	109,131,000	2,983,962	95,913,000
Peat	1,375	(2)	(2)	(2)
Petroleum (crude)—thousand 42-gallon barrels	1,019,164	2,777,900,000	974,275	2,768,490,000
Salt (common)	2,845,190	5,010,624	2,864,312	9,310,339
Sand and gravel	15,101,226	12,845,561	26,315,635	24,840,811
Silver—troy ounces			100	90
Stone (except limestone for cement and lime, 1953)	[3] 9,095,109	[3] 8,550,320	[3] [4] 24,981,897	[3] [4] 28,485,243
Sulfur:				
Frasch process—long tons	3,614,838	97,601,000	3,474,477	92,791,821
Recovered elemental—do	84,717	2,202,381	107,232	2,889,100
Talc and soapstone [5]	16,210	70,658	19,362	127,855
Undistributed: Abrasive stone (1954), native asphalt, bromine, feldspar (1954), gem stones, graphite, lignite, magnesium chloride (for metal), magnesium compounds (except for metals), mercury (1953), pumicite, silver (1954), sodium sulfate, stone (basalt) 1953, dimension sandstone 1954), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2)		39,189,833		52,083,713
Total Texas		3,647,913,000		[6] 3,730,162,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Value included with "Undistributed."
[3] Excludes certain stone, value for which is included with "Undistributed."
[4] Includes oystershell.
[5] Mine production of crude material.
[6] The total value has been adjusted to eliminate duplication in value of stone and clays.

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Texas in 1954 remained the foremost domestic producer of such essential minerals as petroleum, natural gas, natural-gas liquids, helium, sulfur, bromine compounds, oystershell, and magnesium; other minerals produced in significant quantities were cement, clay, gypsum, lime, salt, stone, and sand and gravel. A total of 28 minerals and mineral fuels was produced. Because of the growing problem of water supply, a section on water, principally as an industrial raw material, has been added to the Texas chapter.

The mineral resources of Texas were widely distributed over the entire State, 233 counties of the 254 counties reporting mineral output. Mineral fuels—petroleum, natural gas, natural-gas liquids, and lignite—were reported from about 200 counties in most parts of the State; nonmetals were reported from 150 counties; metals were reported from 4 counties. Seven counties reported mineral value greater than $100 million.

An important part of the State mineral industries recovered secondary products from locally produced minerals (recovered sulfur and carbon black from sour natural gas) or processed minerals and mineral fuels from other States and foreign counties, such as smelters treating copper, lead, and zinc ores, aluminum-reduction plants, processing plants preparing barite, perlite, talc, soapstone, and vermiculite, refineries treating crude oil, and petrochemical plants using natural-gas and refinery end products.

Most of the mineral fuels, both crude and refined products, were consumed in markets outside the State. Pipelines, tankships, and river barges carried most of these products to eastern and northern markets. Demand for products of the base-metal and light-metal smelters was from out-of-State markets. Conversely, nonmetal commodity demand depended primarily on local and intrastate markets. These nonmetal commodities, except sulfur and salt, were essentially materials of construction for industrial, commercial, residential, and farm buildings, for highways and for railroad ballast.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

The 1954 industrial expansion in Texas created unprecedented demand upon many of the State mineral industries. This expansion included many new industries using minerals produced in the State and the expansion or modernization of established industries. Most of the growth was in oil and gas and petrochemical industries. As exploration brought in new fields, refinery facilities were improved to meet the increased demands for diesel and higher octane motor fuels. The petrochemical industries developed new products and new markets for old products. Impetus for expansion was the upward trend in demand for motor fuels for automobiles, diesel locomotives, and trucks; for liquid fuels and gas for heating industrial plants and homes; and for special fuels for the armed services. Facilities for processing many of the nonmetals were expanded, as industrial and residential

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building and highway construction created record demands for cement, gypsum, stone, and sand and gravel.

Employment.—The mineral industries of Texas employed 122,600 persons in 1954, according to the Texas Employment Commission. Employment in the smelting, oil-refining, stone, and clay industries increased this total by 87,500 workers. Wages and salaries of mineral industry workers were estimated at $11.7 million in 1954. Wages and salaries of smelting, oil-refining, and mineral processing employees were estimated at $7.5 million. Wage rates of these workers were higher than the wage rates in most other Texas industries; oil and gas

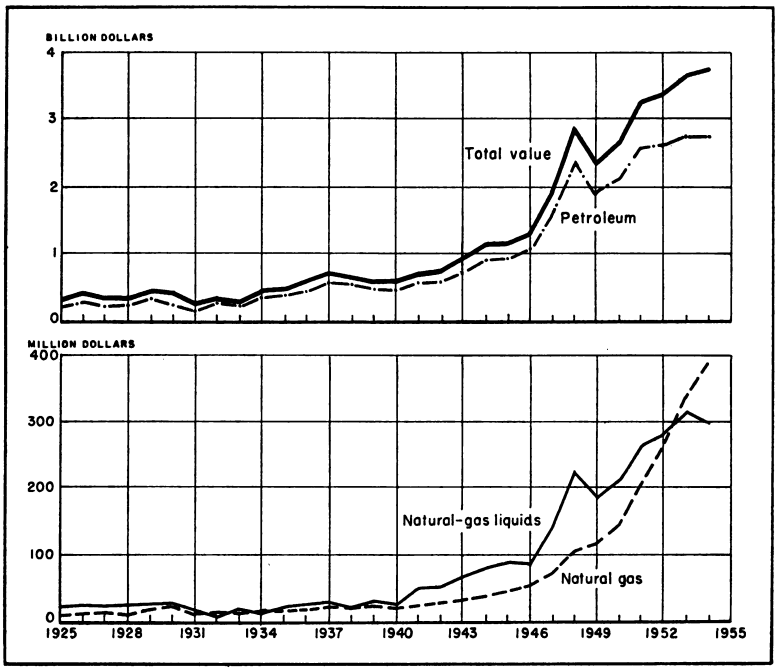

FIGURE 1.—Value of petroleum, natural gas, natural-gas liquids, and total value of mineral production in Texas, 1925–54.

workers received an average of $2.19 an hour, miners and quarrymen, $2.04, oil-refinery workers, $2.37, and smeltermen, $2.02. Other industry-worker wage rates averaged from a high of $2.12 for printers and transportation workers to a minimum of $1.00 to $1.11 for garment and textile-mill workers. Refinery employees worked a fraction over 40 hours a week, while oil and gas workers averaged 44.3 hours.

DMEA Contracts in Texas.—There was one active exploration project for strategic and critical minerals under the Defense Minerals Exploration Administration (DMEA) in Texas in 1954. Amerimex Mining Co. reactivated a project to explore for mercury in its Fresno mine in Presidio County by underground tunnels and surface diamond drilling and trenching.

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REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Mineral fuels—crude oil, helium, lignite, natural gas, and natural-gas liquids—furnished 93 percent of the total mineral value of Texas in 1954. The State also was a leading producer of refined-petroleum products, supplying many other parts of the United States and overseas markets.

Excessive stocks of gasoline and other refined products throughout most of 1954 resulted in less production at refinery operations. Crude runs to refinery stills were below those of 1953, notwithstanding a 2-percent increase in refinery capacity during 1954. Slackened demand for refined products resulted from the following: A slight business recession, which lessened residual fuel-oil demand by industrial plants; milder winter temperatures, reducing the demand for heating oils; and the static demand for gasoline, which prevented any marked liquidation of the large gasoline inventories. The decline in crude-oil production followed an 18-percent decrease in the number of producing days allowed by the Texas Railroad Commission, and the continued decrease in average well production. Exploration for oil and natural gas, on the contrary, continued to new records, as 20,100 completions were recorded. Several important discoveries were made in Ellenburger beds in Andrews, Ector, and Midland Counties and Cambrian beds in Coke and Nolan Counties. Offshore exploration in the tidelands of Texas appeared inevitable, with settlement of Federal and State ownerships of that area.

The demand for Texas lignite achieved new records through its use as a fuel for the electric generators of Aluminum Co. of America reduction works in Milam County.

Asphalt (Native).—Asphaltic limestone for use in road surfacing was produced in Uvalde County by two producers. Output in 1954 was down slightly from that of 1953 with prices steady.

Carbon Black.—The carbon-black industry of Texas furnished 65 percent of the domestic output; 814 million pounds valued at $54 million was produced. This output consumed 157,376 million cubic feet of gas, yielding an average of 2.85 pounds of carbon black per 1,000 cubic feet of gas. Output was reported from 30 plants in 18 counties. The combined daily capacity of 16 channel-type plants and 14 furnace-type plants was almost 3 million pounds. The three principal producers were Sid W. Richardson Co. plants Odessa A, B, and C in Ector County, J. M. Huber Corp. Borger channel plant in Hutchinson County, and Cabot Carbon Co. Shafer plant in Carson County.

Helium.—Texas output (shipments) of helium in 1954 was 111 million cubic feet valued at $1.9 million, a 7-percent rise in quantity and 35-percent rise in value compared with 1953. Defense requirements claimed most of this output, but civilian demands for inert atmospheres in welding certain metals and alloys and for medical purposes increased considerably. The Government plants at Exell, Moore County, and Amarillo, Potter County, supplied the entire production in Texas.

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Lignite.—Lignite production in Texas increased materially in 1954 to meet fuel requirements for the power plant of the Rockdale reduction works of Aluminum Co. of America. Lignite production was reported from Harrison and Milam Counties in 1954.

Natural Gas.—Marketed production of natural gas in Texas was a record 4,551,232 million cubic feet valued at $387 million, an increase of 168,074 million cubic feet (4 percent) over 1953 marketed production. Production was reported from more than 170 of the 254 counties in the State; 61 counties had production over $1 million in value. Gas wells produced about 72 percent of this output and gas from oil wells 28 percent. A total of 2,419,693 million cubic feet of natural gas was shipped to other States from Texas in 1954, 161,062 million cubic feet was used in manufacturing carbon black, 840,070 million cubic feet for repressuring, 806,677 million cubic feet for plant fuel, and 228,698 million cubic feet vented or flared. Gas for manufacturing carbon black continued to decline for the fourth successive year. There was an average of 10,700 producing gas wells in Texas in 1954 compared with an average of 9,700 in 1953.

TABLE 2.—Marketed production of natural gas, 1945–49 (average) and 1950–54 [1]

Year	Million cubic feet	Value (thousand dollars)	Value per thousand cubic feet, in cents	Year	Million cubic feet	Value (thousand dollars)	Value per thousand cubic feet, in cents
1945–49 (average)	2,071,819	78,829	3.8	1952	4,147,805	257,164	6.2
1950	3,126,402	146,941	4.7	1953	4,383,158	333,120	7.6
1951	3,781,136	204,181	5.4	1954	4,551,232	386,855	8.5

[1] Comprises gas either sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas pipelines.

TABLE 3.—Gross withdrawals and disposition of natural gas, 1950–54, in million cubic feet

	Gross withdrawals [1]			Disposition		
Year	From gas wells	From oil wells	Total	Marketed production [2]	Repressuring	Vented and wasted [3]
1950	3,099,600	1,308,200	4,407,800	3,126,402	889,850	391,548
1951	3,518,500	1,411,600	4,930,100	3,781,136	856,930	292,034
1952	3,779,100	1,507,700	5,286,800	4,147,805	784,892	354,103
1953	3,835,000	1,624,000	5,459,000	4,383,158	779,054	296,788
1954	4,020,000	1,600,000	5,620,000	4,551,232	840,070	228,698

[1] Marketed production plus quantities used in repressuring, vented, and wasted.
[2] Comprises gas sold or consumed by producers, including losses in transmission, amounts added to storage, and increases in gas in pipelines.
[3] Includes direct waste on producing properties and residue blown to air. (Partly estimated.)

Estimated proved recoverable reserves of natural gas (including offshore reserves) amounted to 105,129,062 million cubic feet at the end of 1954, a decrease of 1,400,564 million cubic feet during the year.[3] Major increases in the State gas reserves were in the following:

[3] American Gas Association, Proved Reserves of Crude Oil, Natural-Gas Liquids, and Natural Gas: Vol. 9, Dec. 31, 1954, p. 22.

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1. The Lower Cretaceous limestones of East Texas.
2. The Miocene and Wilcox sands along the Gulf Coast and offshore.
3. The deeper pays below the Permian (brown dolomite) in the Hugoton embayment of the Panhandle.
4. The Devonian and Ellenburger dolomites of West Texas.
5. The Atoka conglomerate of North Texas.[4]

Natural-Gas Liquids.—A new production record (5,716 million gallons) for natural-gas liquids was established for the fifth consecutive year in Texas in 1954. LP-gases furnished 52 percent of this output, with natural gasoline and cycle products supplying 48 percent. Most of the natural gasoline was utilized by the refining industry in Texas, but most of the LP-gases was shipped to markets outside the State. Production was reported from 177 absorption plants, 24 compression plants, and 28 cycle plants in 85 counties. The industry built over 10 new gasoline plants; several of the important ones were: The American Republics Corp. plant (20 million cubic feet daily) near Silsbee, Hardin County; the Stanolind Oil & Gas Co. plant near Odessa, Ector County (10 million cubic feet); the El Paso Natural Gas Co. plant near Big Lake, Midland County; the Cities Service Oil Co. plant (21 million cubic feet) near Seminole, Gaines County; and the Woodlawn Processing Corp. plant (45 million cubic feet), Harrison County.

Proved recoverable reserves of natural-gas liquids (including offshore reserves) of Texas were estimated at 2,928 million barrels at the end of 1954, a decrease of 339 million barrels from the estimated reserves in 1953.[5]

TABLE 4.—Production of natural-gas liquids, 1945–49 (average) and 1950–54, in thousand gallons

Year	Natural gasoline and cycle products		LP-gases		Total	
	Thousand gallons	Value (thousand dollars)	Thousand gallons	Value (thousand dollars)	Thousand gallons	Value (thousand dollars)
1945–49 (average)	1,713,113	108,652	959,970	34,165	2,673,083	142,817
1950	2,268,294	156,786	1,665,006	50,266	3,933,300	207,052
1951	2,516,094	189,973	2,042,208	71,943	4,558,302	261,916
1952	2,589,594	188,500	2,456,874	88,635	5,046,468	277,135
1953	2,750,370	200,479	2,777,880	109,131	5,528,250	309,610
1954	2,732,100	200,559	2,983,962	95,913	5,716,062	296,472

TABLE 5.—Production of natural-gas liquids in 1954, by types of products

Product	Thousand gallons	Value (thousand dollars
Natural gasoline	1,974,210	141,955
LP-gases	2,983,962	95,913
Finished gasoline and naphtha	487,956	39,966
Other products	269,934	18,638
Total	5,716,062	296,472

[4] Work cited in footnote 3.
[5] Work cited in footnote 3.

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Peat.—A small quantity of peat was reported from Lee County in 1954.

Petroleum.—Texas 1954 production of crude oil declined for the second successive year from a record high in 1952 and dropped below 1 billion barrels for the first time since 1950. Production was reported from 192 counties in 1954, the same number as in 1953. Ninety-three counties reported production exceeding 1 million barrels each. The 10 leading counties, in order of output, in million barrels, were: Gregg (49.1), Ector (48.8), Andrews (44.0), Scurry (36.1), Rusk (29.2), Brazoria (25.1), Harris (23.8), Wood (22.6), Crane (19.5), and Gaines (19.0).

There were 153,190 producing oil wells in Texas at the end of 1954, an increase of 9,200 wells over 1953. Average daily production amounted to 18.0 barrels per well in 1954, compared with 19.7 barrels per well in 1953. Texas crude averaged $2.84 per barrel in 1954, compared with $2.73 average in 1953, reflecting the general price increase that occurred at mid-year.

TABLE 6.—Production of crude petroleum, 1945–49 (average) and 1950–54

Year	Thousand 42-gallon barrels	Value		Year	Thousand 42-gallon barrels	Value	
		At wells (thousand dollars)	Average per barrel			At wells (thousand) dollars)	Average per barrel
1945–49 (average)	796,693	1,574,378	$1.98	1952	1,022,139	2,641,860	$2.58
1950	829,874	2,147,160	2.59	1953	1,019,164	2,777,900	2.73
1951	1,010,270	2,610,790	2.58	1954	[1] 974,275	[1] 2,768,490	2.84

[1] Final figure. Supersedes preliminary figure in commodity chapter.

TABLE 7.—Production and indicated demand of crude petroleum in 1954, by months

Month	Production (thousand 42-gallon barrels)	Indicated demand (thousand 42-gallon barrels)	Month	Production (thousand 42-gallon barrels)	Indicated demand (thousand 42-gallon barrels)
January	80,486	85,987	August	79,365	81,253
February	74,574	78,077	September	77,408	80,814
March	85,395	80,640	October	78,831	83,810
April	84,965	82,663	November	80,477	83,181
May	84,581	82,581	December	83,642	86,529
June	83,263	79,219			
July	81,288	81,366	Total	974,275	986,120

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TABLE 8.—Production of crude petroleum, 1950–54, by districts and fields

(Thousand barrels)

	1950	1951	1952	1953	1954 [2]
District and field: [1]					
Gulf Coast:					
Amelia	715	1,073	1,004	1,282	1,161
Anahuac	6,801	7,727	7,032	6,453	5,240
Barbers Hill	2,110	2,038	2,132	1,862	1,805
Beaumont, West	499	662	986	1,148	1,035
Bloomington	1,775	1,934	1,756	1,535	1,341
Boling	1,019	1,110	1,524	1,959	1,763
Chocolate Bayou	4,272	5,166	5,028	4,531	4,952
Conroe	11,943	14,081	12,813	11,937	10,081
Damon Mound	89	147	369	605	1,153
Dickinson-Gillock	3,493	4,090	4,105	4,235	4,030
Dyersdale	1,550	1,449	1,340	1,183	975
Esperson	1,508	1,496	1,474	1,365	1,284
Fairbanks	1,696	1,403	1,383	1,585	1,426
Falls City	1,101	1,341	1,232	1,059	898
Fannette	1,425	1,737	1,780	1,760	1,380
Francitas	148	280	656	962	1,172
Friendswood	11,386	14,989	13,729	12,398	10,378
Gohkle, Helen	[3]	955	2,180	2,512	2,478
Goose Creek	2,451	2,873	3,148	2,692	2,715
Greta	2,858	3,512	3,269	2,871	2,370
Hankamer	523	835	1,136	1,072	1,110
Hastings	13,247	16,536	14,767	13,644	11,570
Heyser	1,288	1,671	1,491	1,361	1,064
High Island	2,380	2,384	2,291	2,605	2,819
Houston, South	1,193	1,192	1,255	1,286	1,377
Hull	3,534	4,612	[4] 3,388	2,660	4,411
Humble	1,257	1,246	1,036	958	1,067
Liberty, South	2,064	1,665	1,626	2,011	2,348
Livingston	1,373	1,395	1,208	1,154	1,086
Lolita	1,502	1,803	1,589	1,476	1,247
Lovells Lake	1,220	1,418	1,217	978	863
McFaddin	1,126	1,339	1,368	1,275	1,076
Manvel	2,011	2,393	2,166	2,058	1,735
Markham	1,139	1,333	1,585	1,691	1,548
Old Ocean	5,521	6,247	6,268	5,954	4,994
Oyster Bayou	2,418	3,519	3,368	3,219	3,104
Pierce Junction	1,444	1,782	1,591	1,349	1,036
Placedo	1,944	2,291	1,997	2,210	1,951
Port Neches	718	1,621	1,847	1,846	1,687
Raccoon Bend	1,657	1,874	1,966	2,225	2,068
Refugio-Fox	2,442	2,708	2,655	2,419	2,330
Saratoga	701	673	758	675	1,417
Silsbee	1,223	1,364	1,465	1,398	1,248
Sour Lake	1,883	2,009	1,804	1,576	1,451
Stowell	2,288	2,336	2,360	1,936	1,645
Sugarland	1,059	1,380	1,294	1,193	933
Sugar Valley	2,056	1,943	1,468	1,364	1,143
Thompson	10,187	12,840	11,846	10,563	9,099
Tomball	2,212	2,444	2,204	2,095	1,888
Village Mills	2,291	3,300	3,216	3,494	2,871
West Columbia	2,619	2,331	2,297	2,252	2,344
West Ranch	5,456	7,525	6,844	6,652	5,427
Withers-Magnet	3,718	4,345	4,018	3,933	3,467
Other Gulf Coast [5]	56,730	68,990	69,268	73,120	62,098
Total Gulf Coast	199,263	239,407	231,597	227,636	203,159
East Texas:					
East Texas proper	97,825	100,695	96,526	90,743	81,364
Cuyuga	1,808	1,568	1,373	1,258	1,082
Ham Gossett	[3]	465	1,040	1,186	1,099
Hawkins	10,439	13,638	16,261	18,417	16,589
Long Lake	1,415	1,619	1,476	1,236	959
New Hope	1,836	2,355	2,309	2,191	2,481
Pewitt Ranch	434	1,874	1,637	1,444	1,209
Pickton	754	2,027	1,383	1,788	1,477
Quitman	2,740	3,078	2,848	2,941	2,230
Talco	5,891	6,692	6,440	5,876	4,928
Van	7,358	9,698	11,349	10,650	8,850
Waskom	444	896	1,131	1,398	1,049
Other East Texas	13,247	17,641	15,664	13,770	15,366
Total East Texas	144,191	162,246	159,437	152,898	138,683

See footnotes at end of table.

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TABLE 8.—Production of crude petroleum, 1950–54, by districts and fields—Con.

(Thousand barrels)

	1950	1951	1952	1953	1954 [2]
District and field [1]—Continued					
Central Texas:					
Big Foot	154	456	793	1,792	2,413
Charlotte	2,223	2,434	1,778	1,536	1,760
Darst Creek	2,534	2,830	2,943	3,210	3,442
Luling	1,608	1,951	2,385	2,410	2,433
Other Central Texas	3,250	3,846	4,148	4,733	5,110
Total Central Texas	9,769	11,517	12,047	13,681	15,158
North Texas [6 7]	79,998	87,985	96,513	111,269	114,979
Panhandle [8]	33,131	31,287	29,272	28,080	30,903
South Texas:					
Aqua Dulce	2,094	2,232	1,945	1,736	1,500
Flour Bluff	916	1,016	1,066	1,200	1,286
Fulton	1,202	1,819	1,945	2,718	2,985
Garcia	1,064	1,321	1,294	1,223	1,057
Hoffman	1,069	2,154	1,983	1,841	1,500
Kelsey	2,284	3,017	3,059	3,243	3,173
London Gin	974	1,330	1,192	1,106	955
Mustang Island	(3)	1,332	2,154	2,878	2,697
Saxet-Saxet Frio	1,499	1,176	980	998	830
Stratton	3,150	3,680	3,344	2,990	2,403
Sun	1,260	1,293	1,405	1,618	1,752
Taft	1,096	1,491	1,477	1,491	1,580
White Point	2,674	3,391	3,312	3,319	2,973
Willamer and West	2,092	2,205	3,152	2,920	2,434
Other South Texas	55,452	69,092	66,665	65,377	61,158
Total South Texas	76,826	96,549	94,973	94,658	88,283
West Texas by counties:					
Andrews	31,860	37,308	38,225	39,305	43,969
Borden	2,978	8,981	9,614	8,888	5,728
Coke	3,852	4,790	5,817	9,397	13,553
Crane-Upton	22,973	31,557	42,500	39,282	37,260
Crockett	7,078	8,574	8,725	8,532	8,447
Dawson	1,534	2,305	2,300	2,469	2,664
Ector [9]	57,096	69,576	69,516	55,779	51,484
Gaines-Yoakum	28,703	35,742	34,854	36,941	36,122
Garza	3,364	4,199	3,802	3,787	4,230
Glasscock-Howard-Mitchell	8,977	11,598	9,597	16,841	20,114
Hockley [10]	27,597	31,338	30,263	26,832	22,804
Kent	3,525	7,121	6,980	7,638	6,568
King	863	1,090	978	806	676
Midland	873	9,598	14,885	10,054	12,787
Pecos	17,862	22,305	22,004	20,358	17,672
Reagan	2,372	2,031	3,007	6,629	11,024
Reeves	1,090	1,295	1,609	1,299	728
Runnels	1,063	7,703	6,052	10,205	6,185
Scurry	36,529	48,478	48,077	43,421	36,050
Schleicher	350	863	2,465	3,179	3,298
Terry	1,172	3,391	5,102	6,647	6,106
Tom Green	1,152	1,911	1,618	1,173	1,369
Ward	5,380	8,281	11,521	10,221	9,548
Winkler	17,961	19,228	16,653	16,111	14,928
Other West Texas	492	2,016	2,136	5,148	9,796
Total West Texas	286,696	381,279	398,300	390,942	383,110
Total Texas	829,874	1,010,270	1,022,139	1,019,164	974,275

[1] Texas Railroad Commission district data adjusted to Bureau of Mines State total.
[2] Final figures.
[3] Included with "Other."
[4] A new field was created out of a portion of Hull and included in "Other Gulf Coast."
[5] Includes crude oil consumed on leases for entire district.
[6] Includes the fields in and between Hardeman, Wilbarger, Wichita, Clay, Montague, and Cook Counties on the north and San Saba, Lampasas, and Coryell on the south.
[7] Includes crude oil consumed on leases and net change in stocks held on leases for East (exclusive of East Texas proper), Central, North, and South Texas.
[8] Carson, Gray, Hutchinson, Moore, Sherman, and Wheeler Counties.
[9] Includes the part of Jordan pool in Crane County.
[10] Includes Slaughter and Levelland fields.

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In 1954, 20,123 wells were drilled in search of crude oil and natural gas, an increase of 1,740 wells (9 percent) over those completed in 1953. Of the 20,123 completions, 4,379 wells were classed as wildcats, of which 664 were oil wells, 112 were gas wells, and 3,603 were dry. There were 15,744 exploratory wells drilled in 1954, of which 11,367 were oil wells, 815 discovery wells, the remainder in new oil pays and extensions to existing fields, 1,007 gas wells, and 3,370 dry.[6] Estimated proved recoverable reserves of crude oil declined to 14,982 million barrels, according to the American Petroleum Institute, notwithstanding the industry's aggressive exploratory program, which added 680 million barrels of reserves through extensions and revisions of existing fields, while new discoveries added 255 million barrels. Texas continued to supply over 50 percent of the nation's total crude-oil reserves at the end of 1954.

Indicated demand for crude in Texas in 1954 amounted to 986 million barrels, compared with 1,024 million barrels in 1953. Daily average demand in 1954 declined to 2,702,000 barrels from the 1953 daily average of 2,805,000 barrels. Crude-oil stocks in Texas as of December 31, 1954, amounted to 88.4 million barrels, of which 73.3 million barrels was in pipelines and tank farms, and 15.1 million barrels at 75 Texas refineries.

There were 57 oil refineries in Texas at the end of 1954, with a total daily crude capacity of 2,273,000 barrels, about 27 percent of the national total. Refinery capacities varied from less than 5,000 to 282,000 barrels per day. Almost 90 percent of this capacity was along the Gulf Coast area, centering around the Corpus Christi, Houston, Baytown, Texas City, Beaumont, and Port Arthur areas. These Gulf coast locations offered cheap water transportation to East coast markets by ocean tankers and to Midwest markets by barge via the Intercoastal Canal and the Mississippi River, and by pipeline.

TABLE 9.—Runs to stills of crude petroleum and refinery receipts and output from stills in 1954 by months[1]

(42-gallon barrels)

Month	Runs		Output					
	Crude	Products	Cracking stock	Gasoline	Kerosine distillate gas oil	Miscellaneous products	Processing loss	Total
January	59,113,490	5,042,999	1,666,172	28,015,300	17,265,515	13,963,408	3,216,793	64,127,188
February	55,983,107	4,677,603	2,022,109	25,511,096	16,946,920	13,707,056	2,466,732	60,653,913
March	61,008,329	5,961,979	1,634,750	29,134,677	18,132,919	14,096,384	3,947,319	66,946,049
April	59,409,223	5,281,958	2,037,943	29,105,046	17,863,144	13,815,842	1,866,205	64,688,180
May	60,657,854	4,329,434	2,720,785	28,557,139	16,054,485	15,000,007	2,654,872	64,987,288
June	57,063,735	6,107,565	1,789,625	29,166,876	15,434,776	14,853,463	1,897,403	63,142,143
July	58,836,149	6,815,854	1,238,452	30,260,090	17,467,612	14,308,628	2,377,231	65,652,003
August	59,523,257	6,760,484	1,229,339	30,492,529	17,496,114	14,516,535	2,547,127	66,281,644
September	58,935,470	5,679,689	1,541,637	28,550,723	17,665,171	14,716,665	2,138,033	64,612,229
October	60,268,024	5,401,281	2,106,555	30,191,883	17,443,716	15,213,033	657,837	65,613,024
November	58,119,471	5,880,169	1,678,882	28,784,986	18,560,357	13,847,925	1,127,190	63,999,340
December	58,992,555	5,630,819	1,778,784	28,888,121	17,302,793	14,371,722	2,263,340	64,604,760
Total	707,910,664	67,569,834	21,445,033	346,658,456	207,633,522	172,410,668	27,160,082	775,307,761
Percent:								
1954			2.77	44.70	26.78	22.24	3.50	
1953			2.29	44.30	27.03	22.26	4.31	

[1] Oil and Gas Division, Railroad Commission of Texas, Annual Report: 1954, 281 pp.

[6] Work cited in footnote 3.

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TABLE 10.—Stocks of crude petroleum at refineries, in pipelines, tank farms, and gathering systems in 1954, by months, in 42-gallon barrels [1]

Month	Refineries	Oil in lines	Lease tanks	Gathering systems, pipeline tank farms, and terminals	Total storage
January	17,082,120	18,564,724	11,598,032	60,891,204	108,136,080
February	16,390,613	18,320,464	11,563,206	56,729,768	103,004,051
March	17,078,561	18,883,306	11,287,589	58,291,783	105,541,239
April	17,544,088	18,656,479	11,437,585	59,735,105	107,373,257
May	17,038,747	18,740,787	11,691,650	62,235,360	109,706,544
June	18,299,123	18,804,092	11,697,209	63,844,445	112,644,869
July	18,034,302	18,960,402	11,727,896	67,262,929	115,985,529
August	17,845,554	18,906,220	11,572,788	63,814,737	112,139,299
September	16,520,489	18,720,241	11,582,153	62,730,062	109,552,945
October	16,282,277	18,840,902	12,107,447	59,520,506	106,751,132
November	14,710,212	18,728,396	11,626,555	58,182,742	103,247,905
December	15,837,986	18,763,179	11,625,646	60,144,436	106,371,247

[1] Oil and Gas Division, Railroad Commission of Texas, Annual Report: 1954, 281 pp.

TABLE 11.—Sales of petroleum products, 1950–54

(Thousand 42-gallon barrels)

Product	Quantity sold				
	1950	1951	1952	1953	1954
Gasoline	70,322	83,668	93,663	109,848	106,245
Kerosine	3,817	3,181	2,921	2,638	2,383
Range oil [1]	2,064	2,826	2,386	2,205	1,963
Distillate fuel oil	12,790	16,183	19,022	19,046	18,913
Residual fuel oil [2]	47,924	49,750	44,631	40,981	35,436

[1] Includes kerosine sold as range oil.
[2] Excludes crude oil used as residual fuel oil as follows: 1950–636, 1951–714, 1952–1,877, 1953–997, 1954–876.

TABLE 12.—Stocks of refined products at refineries, gasoline and recycling plants, tank farms, and terminals in 1954, by months [1]

(42-gallon barrels)

Month	Cracking stock	Gasoline	Kerosine distillate gas oil	Fuel oil	Natural gasoline	Miscellaneous products	Total in storage
January	6,156,687	26,864,811	16,674,108	10,687,635	2,017,299	8,745,287	71,145,827
February	7,166,106	27,924,882	13,987,987	11,166,831	2,211,272	8,680,565	71,137,643
March	7,653,175	27,306,265	15,049,227	11,078,075	2,186,865	8,153,964	71,427,571
April	7,517,335	25,896,895	16,007,474	10,971,295	3,283,221	8,205,583	71,881,803
May	8,490,028	23,221,121	17,708,285	9,832,091	2,697,017	9,382,453	71,330,995
June	8,079,095	20,853,159	18,959,607	12,567,868	2,566,877	8,818,296	71,844,902
July	7,257,600	21,244,905	22,673,700	10,932,477	2,101,456	9,150,509	73,360,647
August	6,438,453	22,505,935	24,908,270	11,510,841	1,856,701	8,980,842	76,201,042
September	6,525,212	21,037,333	28,427,954	12,310,650	2,119,663	8,342,096	78,762,908
October	6,983,650	21,557,842	28,821,277	13,093,817	2,170,876	9,114,230	81,741,692
November	6,644,761	22,834,947	27,086,856	11,181,635	1,936,380	7,799,355	77,483,934
December	6,717,874	21,810,040	28,112,025	12,195,367	2,075,639	8,418,560	79,329,505

[1] Oil and Gas Division, Railroad Commission of Texas: Annual Report, 1954, 281 pp.

METALS

Iron ore, magnesium, and a small quantity of silver were the only metallic minerals produced in Texas in 1954. However, there were 15 large metallurgical plants in the State, including 2 blast furnaces,

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3 aluminum-reduction works, 1 alumina plant, 1 antimony smelter, 1 copper smelter and a refinery, 1 lead smelter, 1 magnesium plant, 1 tin smelter, 2 zinc-retort smelters, and 1 electrolytic zinc plant.

One blast furnace of Lone Star Steel Co. was at Daingerfield, Morris County, the other of Sheffield Steel Co., at Houston, Harris County. Aluminum Co. of America, Rockdale, Milam County, reduction plant, and Reynolds Metals Co. San Patricio plant in San Patricio County, began capacity operations in 1954. Aluminum Co. of America also operated its Point Comfort plant in Calhoun County. National Lead Co. operated its antimony smelter at Laredo, Webb County. American Smelting & Refining Co. had a zinc-retort smelter at Amarillo, Potter County, an electrolytic zinc smelter at Corpus Christi, Nueces County, and a lead and a copper smelter at El Paso. A copper refinery of the Phelps Dodge Corp. was also at El Paso. American Zinc Co. of Illinois operated a zinc-retort smelter at Dumas in Moore County. Magnesium was produced by the Dow Chemical Co. Freeport plant, and at the Government plant, Velasco, Brazoria County. Tin was produced at the Texas City smelter, Galveston County, by the Tin Processing Corp. Dow Chemical Co. was building a plant to recover magnesium amounting to about 2.5 million pounds of metal a year from previously discarded sludge.

All of the crude material treated at these plants (except the sea water for the magnesium works and iron ore for the blast furnaces) was shipped from other States or from foreign countries. Most of the products from these plants was consumed out-of-State.

Aluminum and Bauxite.—Texas was the second-ranking primary aluminum producer in the United States, with a total annual capacity of 260,000 tons and a planned expansion of 65,000 tons in 1954. Alumina was shipped from other States and imported. Reynolds Metal Co. obtained alumina from its La Quinta plant in San Patricio County, which had begun limited production in late 1953 and was nearly completed at the end of 1954. The Aluminum Co. of America four-potline plant, Rockdale, was operated at capacity for the first full year in 1954. Production had begun in 1952; the plant was formally dedicated April 24, 1954.

Iron Ore.—Open pits in Cass, Cherokee, and Morris Counties supplied 920,000 long tons of iron ore produced in 1954 for the blast furnaces of Lone Star Steel Co., Daingerfield, and for Sheffield Steel Co., Houston. The growing demand for oilfield equipment and the expanding industrial development on the Gulf coast kept these two furnaces operating at capacity.

Magnesium.—Magnesium was recovered from sea water by Dow Chemical Co. in 1954 at both its Freeport plant and the Government-owned Velasco plant in Brazoria County. Output declined slightly from that of 1953 as accumulated stock rose. Dow Chemical renewed its contract to operate the Velasco plant before congressional action was taken to dispose of the plant.

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TABLE 13.—Mine production of gold, silver, copper, lead, and zinc, 1945–49 (average), 1950–54, and total 1885–1954, in terms of recoverable metals [1]

Year	Ore	Gold		Silver		Copper	
	Short tons	Fine ounces	Value	Fine ounces	Value	Short tons	Value
1945–49 (average)	3,588	30	$1,030	18,498	$15,006	22	$7,556
1950 [2]	[2] 935	49	1,715	2,454	2,221	2	832
1951 [2]	750	32	1,120	1,381	1,250	1	483
1952	1,270	39	1,365	4,672	4,228	18	8,712
1953							
1954	(4)			100	90		
1885–1954	(4)	8,552	233,265	33,303,273	23,446,654	1,383	402,028

Year	Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	
1945–49 (average)	85	$27,056	13	$3,212	$53,887
1950 [2] [3]	129	34,830			39,598
1951 [2]	43	14,878	24	8,736	26,467
1952	56	18,032	3	996	33,333
1953					
1954					90
1885–1954 [4]	5,443	692,471	837	132,283	24,906,701

[1] Includes recoverable metal content of ore shipped during the calendar year indicated.
[2] All of 1950 production was from 1 mine in Presidio County, which produced lead ore.
[3] Does not include zinc and lead recovered by the slag-fuming plant at El Paso smelter from old accumulated slag resulting from operations in previous years.
[4] Data not available.

Manganese.—A. L. Neyland shipped a limited tonnage of manganiferous material produced in Jeff Davis County to the Deming, N. Mex. Government Purchase Depot.

Silver.—A small quantity of silver was recovered from several base-metal prospects in Presidio County.

Uranium.—Considerable exploration activity for radioactive material was reported in Texas in 1954, with the oil and gas industry expanding its electrical-detection practices during well drilling. Mineral leasing of Texas land expanded to include other minerals beside oil and gas. Radiometric surveys, both airborne and ground, were carried on by private companies, the Federal Geological Survey, and AEC. Several exploration projects for uranium were reported during the year.

NONMETALS

The 1954 value of nonmetals produced in Texas was $272 million (8 percent of the total value). Of the 18 nonmetals reported, the 6 principal minerals, in the order of their value, were: Sulfur, cement, stone, sand and gravel, magnesium chloride, and bromine. All construction minerals showed marked increases in 1954 value over 1953, owing primarily to increasing industrial, residential, and highway construction in Texas. Most of the demand originated within the State, and only a small portion was shipped to other States.

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Abrasives (Grinding Pebbles).—A limited quantity of grinding pebbles from Travis County was prepared by Dezendorf Marble Co.

Barite.—Barite from other States and foreign countries was ground and processed by three companies in Texas in 1954. The quantity and value of this processed material were greater in 1954 than in 1953, largely because increased exploratory drilling activities of the oil and gas industry created a larger demand for barite in drilling mud. Specifications for drilling muds became more rigid because of deeper drilling with improved drilling equipment and techniques. The crude barite was processed by Baroid Sales Division of National Lead Co., Nueces County, by Magcobar, Inc., Cameron County, and by Milwhite Co., Harris County.

Bromine.—Texas remained the foremost producing State and Ethyl-Dow Chemical Co. the foremost producer of bromine in the Nation in 1954. Output and value were both greater in 1954 than in 1953. Most of the bromine was produced as ethylene dibromide and used as an additive in antiknock compounds of motor fuels. The increased demand for ethylene dibromide followed similar demands for gasoline. The oil-refining industry of Texas consumed most of this bromine compound output, but a substantial portion was for out-of-State markets.

Cement.—Production, shipments, and value of cement in Texas established new records in 1954 as the industry expanded and improved its production and storage facilities during the year. The impetus for this impressive increase in demand was the backlog of school, hospital, commercial, and highway construction and an accelerated demand for industrial and residential construction. The 1954 shipments exceeded production for the first time in 3 years, notwithstanding increases in both output and plant capacities during the year. Some of these improvement programs were begun in 1953 and completed in 1954. Most of this increased capacity involved installing equipment to facilitate internal processing, and handling material, and removing bottlenecks in plant operation rather than increasing the number of kilns. Production was reported from 13 plants in 8 counties. Oystershell replaced limestone as the basic cement material at four plants along the Gulf Coast.

TABLE 14.—Portland cement produced and shipped, 1945–49 (average) and 1950–54

(376-pound barrels)

Year	Production (barrels)	Shipments		
		Barrels	Value	
			Total	Average per barrel
1945–49 (average)	11,972,485	12,052,501	$24,522,259	$2.04
1950	17,150,293	17,281,521	39,677,804	2.30
1951	18,132,373	17,642,654	42,648,536	2.42
1952	19,997,983	19,849,455	48,042,901	2.42
1953	19,253,677	19,140,193	48,497,762	2.53
1954	21,541,325	21,928,170	56,674,124	2.58

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Clays.—Texas has extensive and widely distributed clay deposits, many of which were exploited for manufacturing brick, heavy clay products, lightweight aggregate, cement, drilling mud, and filtering aids in 1954. Twenty-eight companies operated 42 brick and tile plants in 30 Texas counties. The clay output in 1954 totaled 2.4 million tons valued at $7 million; miscellaneous clay supplied nearly 80 percent of the output and 42 percent of the value, followed by fire clay with 14 and 31 percent; bentonite with 4 and 19 percent; and fuller's earth 2 and 8 percent, respectively.

Miscellaneous clay was used for manufacturing tile, cement, and lightweight aggregate. Fire clay was used for heavy clay products and refractory brick. Bentonite and fuller's earth were used as filtering and decolorizing agents for oils and for heavy drilling muds, with a small quantity as a filler.

A. P. Green Fire Brick Co., acquired the facilities of Thermo Fire Brick Co., Sulphur Spring, Tex., during 1954.

TABLE 15.—Clays sold and used by producers, 1945–49 (average) and 1950–54, by kinds

Year	Bentonite		Fire clay		Fuller's earth	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	24,446	$234,288	206,510	$674,770	101,945	$1,138,878
1950	24,574	321,345	307,026	675,770	112,466	1,393,773
1951	38,425	212,670	320,238	764,228	142,273	1,952,304
1952	31,386	584,938	358,466	1,064,005	105,565	1,030,005
1953	47,887	670,300	356,211	915,575	106,437	1,277,670
1954	105,744	1,299,380	347,247	2,187,866	62,788	590,135

Year	Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value
1945–49 (average)	1,133,155	$1,092,900	1,466,056	$2,962,047
1950	1,595,211	1,625,503	2,039,277	4,015,391
1951	1,716,117	2,015,763	2,217,053	4,944,965
1952	1,573,603	1,791,234	2,069,020	4,470,182
1953	1,860,440	1,815,429	2,370,975	4,678,974
1954	1,885,145	2,924,643	2,400,924	7,002,024

Feldspar.—Crude feldspar was produced and ground in Texas in 1954 by Dezendorf Marble Co., for use principally as roofing material.

Gem Stones.—Gem stones were collected, cut, and polished by an increasing number of dealers and amateur enthusiasts in 1954. Gem-type minerals found in Texas included: Agate, jasper and clear quartz, petrified and agatized wood, garnet, topaz, opal, amethyst, chrysocolla, obsidian, fluorite, apatite, labradorite, and adularia, a variety of feldspar. Most of the stones were found in the following regions: Zapata and Webb Counties in south Texas, Presidio, Brewster, Culberson, Hudspeth, and Jeff Davis Counties in west Texas, and Mason County in central Texas.

Graphite.—Southwestern Graphite Co. closed its Burnet County plant in January 1954 because of poor market conditions. Limited shipments were made from existing stocks during the year. The

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plant can produce 25 percent of the Nation's requirements of flake graphite.

Gypsum.—The gypsum industry of Texas established a new record in 1954, with an output of 1.2 million tons valued at $3.8 million. This increase, owing to the continued industrial expansion in Texas and the southwest region, resulted from unprecedented demands for such building and construction materials as wallboard, lathe, and plasters. Production was reported by five companies from Fisher, Hardiman, Hudspeth, and Nolan Counties. United States Gypsum Co. remained the principal producer in Texas in 1954.

TABLE 16.—Gypsum mined and calcined gypsum produced, 1945–49 (average) and 1950–54

Year	Crude gypsum mined, value			Calcined gypsum produced, value		
	Short tons	Total	Average per ton	Short tons	Total	Average per ton
1945–49 (average)	749, 580	$1, 693, 049	$2. 26	505, 291	$3, 236, 383	$6. 41
1950	1, 076, 251	2, 771, 812	2. 58	752, 615	5, 566, 132	7. 40
1951	1, 136, 824	2, 987, 890	2. 63	793, 562	6, 509, 550	8. 20
1952	1, 021, 161	2, 682, 019	2. 63	707, 654	5, 960, 375	8. 42
1953	1, 067, 854	2, 860, 633	2. 68	730. 083	7, 020, 270	9. 50
1954	1, 218, 048	3, 773, 230	3. 10	481, 161	6, 072, 185	12. 62

Lime.—The 1954 output of lime from both limestone and oystershell increased 15 percent in quantity to 547,000 tons and 24 percent in value to $5.4 million when compared with 1953. Production was reported by 10 producers from the following 7 counties: Comal, El Paso, Harris, Johnson, Nueces, Travis, and Williamson. Oystershell replaced high-calcium limestone as the basic material in lime production in Harris and Nueces Counties. Lime was used chiefly as building lime and for chemical and industrial purposes, such as water purification, sewage treatment, steel-furnace flux, petroleum refining, and manufacturing paper and calcium carbide. The petrochemical industry also used significant quantities of lime in its operations. Most of the Texas lime output was consumed by industries within the State; sizable shipments were made to Louisiana and Mississippi.

TABLE 17.—Lime (quick and hydrated) sold by producers, 1945–49 (average) and 1950–54

Year	Quicklime (short tons)	Hydrated lime (short tons)	Total	
			Short tons	Value
1945–49 (average)	93, 794	47, 028	140, 822	$1, 291, 566
1950	163, 268	53, 171	216, 439	2, 074, 367
1951	212, 784	67, 173	279, 957	2, 532, 387
1952	209, 904	71, 700	281, 604	2, 622, 975
1953	256, 000	219, 569	475, 569	4, 380, 331
1954	306, 433	241, 003	547, 436	5, 421, 732

Magnesium Compounds.—Compounds of magnesium were produced by the Dow Chemical Co. Freeport plant, Brazoria County. Demand of the chemical and pharmaceutical industries was somewhat greater in 1954 than in 1953.

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Natural Salines.—Sodium sulfate was recovered from brines in Ward County in 1954.

Perlite (Expanded).—Crude perlite from New Mexico was expanded by 6 producers with plants in 4 counties. Most of the 1954 output was consumed as lightweight aggregate in concrete and plaster. The principal markets were the large industrial and urban areas within the State.

Pumicite (Volcanic Ash).—Pumicite output, for use principally as an admixture for concrete and acoustic plaster and in lesser quantities as an abrasive medium in cleaning and scouring compounds, was reported from Dickens, Scurry, and Starr Counties in 1954.

Salt.—Production and value of salt in Texas established new records for the fourth consecutive year in 1954 when 2.9 milllon tons valued at $9.3 million was reported. Of 7 counties, Brazoria, Harris, and Duval were the 3 principal producers. Most of the production was recovered as brine from salt domes, part of which was evaporated; followed by rock salt from mines. The chemical industry consumed most of the salt for manufacturing chlorine and soda ash. Other important industries using salt were meat packing, fish curing, dairy products, refrigeration, feed for livestock, and the metals extractive industry. A significant quantity of salt was also used in water purification and softening. Salt in sea water enters into the recovery of magnesium compounds and bromine.

TABLE 18.—Salt sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1945–49 (average)	1,277,256	$1,783,014	$1.40	1952	2,640,209	$4,402,032	$1.67
1950	1,852,138	2,846,789	1.54	1953	2,845,190	5,010,624	1.76
1951	2,401,063	4,000,100	1.67	1954	2,864,312	9,310,339	3.25

Sand and Gravel.—Extensive deposits of sand and gravel suitable for concrete aggregate and road material are widespread in Texas, generally found along or adjacent to the larger streams in the State. The 1954 output of 26 million tons valued at $24.8 million ranked fourth in the Nation and established a new record for the State. Part of this increase is attributable to expanded coverage.

TABLE 19.—Sand and gravel sold or used by producers, 1945–49 (average) and 1950–54

Year	Commercial operations		Government-and-contractor operations		Total sand and gravel		
	Short tons	Value	Short tons	Value	Short tons	Value	
						Total	Average per ton
1945–49 (average)	11,651,413	$10,074,414	1,460,822	$425,867	13,112,235	$10,500,281	$0.80
1950	15,725,012	15,273,384	2,247,093	434,340	17,972,105	15,707,724	.87
1951	14,657,441	14,775,101	3,831,022	876,430	18,488,463	15,651,531	.85
1952	15,998,314	16,602,593	2,663,089	672,662	18,661,403	17,275,255	.93
1953	11,866,963	12,426,922	3,234,263	418,639	15,101,226	12,845,561	.85
1954	23,136,286	23,892,530	3,179,349	948,281	26,315,635	24,840,811	.94

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TABLE 20.—Uses of sand and gravel produced in 1954

Use	Short tons	Value		Use	Short tons	Value	
		Total	Average per ton			Total	Average per ton
Sand:				Gravel:			
Glass sand	285,360	$555,916	$1.95	Paving gravel	8,164,540	$6,464,748	$0.79
Molding sand	76,757	192,941	2.51	Railroad ballast gravel	764,711	449,099	.59
Paving sand	3,038,950	2,164,126	.71	Structural gravel	6,895,158	8,544,819	1.24
Railroad ballast sand	52,970	40,636	.77	Other gravel	1,192,180	729,318	.61
Structural sand	5,330,839	4,861,153	.91				
Other sand	400,182	340,261	.85				
Undistributed [1]	113,988	497,794		Total	17,016,589	16,187,984	.95
Total	9,299,046	8,652,827	.93				

[1] Includes blast, engine, and filter sands.

Commercial production furnished nearly 90 percent of the output; Government-and-contractor production supplied the remainder. Most of the sand and gravel was used for building, paving, and road purposes. Industry, specialty, glass, molding, blast, engine, and filtering uses consumed the remaining 7 percent. Over 70 percent (18.5 million tons) of the total sand and gravel produced in 1954 was washed, screened, and otherwise prepared. A significant trend was the increased use and deployment of portable plants by contractors on highway projects and by producers in the heavily populated centers. Washed and prepared material averaged $1.12 a ton, and unprepared material brought 68 cents a ton. The Texas Highway Department was responsible for almost all of the Government-and-contractor output; as most of the county highway units reported use of purchased material. Production by the State units was evenly divided by their own crews and by contractors working expressly for the State.

Stone.—Production of stone (including oystershell) in 1954 amounted to 25 million tons valued at $28 million; oystershell and stone used for cement and lime are included in these totals. Stone was reported from 55 counties by 87 producers, and 12 producers reported oystershell from 6 counties. Commercial stone production supplied 10.8 million tons (43 percent) valued at $13.3 million (47 percent) and Government-and-contractor production the remainder.

TABLE 21.—Stone sold or used by producers, 1950–54

Year	Marble		Limestone		Sandstone	
	Short tons	Value	Short tons	Value	Short tons	Value
1950	10,550	$278,500	3,800,700	$4,682,090	127,290	$124,642
1951	10,675	303,500	5,928,140	6,464,008	376,957	276,847
1952	16,500	350,000	5,343,324	6,634,047	879,561	667,671
1953	(1)	(1)	6,251,667	6,404,938	(1)	(1)
1954	(1)	(1)	13,482,633	14,385,288	(1)	(1)

See footnotes at end of table.

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TABLE 21.—Stone sold or used by producers, 1950–54—Continued

Year	Miscellaneous		Total Stone	
	Short tons	Value	Short tons	Value
1950	954, 610	$495, 231	[1] 4, 893, 150	[1] $5, 580, 463
1951	1, 035, 297	581. 767	[1] 7, 351, 069	[1] 7, 626, 122
1952	1, 265, 484	739, 670	[2] 7, 604, 468	[2] 8, 664, 633
1953	2, 022, 271	1, 090, 319	[4] 9, 095, 109	[4] 8, 550, 320
1954	1, 297, 563	1, 111, 646	[4] 24, 981, 897	[4] 28, 485, 243

[1] Excludes certain stone, Bureau of Mines, not at liberty to publish.
[2] Includes 99,599 tons of granite and basalt, valued at $273,245.
[3] Bureau of Mines not at liberty to publish; included in total.
[4] Includes granite and oystershell.

Limestone was the principal stone produced in Texas, followed by oystershell, miscellaneous stone, sandstone, basalt, marble, and granite. Crushed limestone was used mostly for concrete aggregate, road-base material, cement, lime, and asphalt filler; dimension limestone was used principally for dressed and rough building stone and for flagging. Counties producing over 1 million tons were Bexar, Comal, Dallas, El Paso, and Wise. Principal commercial limestone producers were Southwest Stone Co., Servtex Material Co., G. C. McBride Co., Houston-Clinton Co., and McDonough Bros., Inc. Cement or lime companies were not included in the listing but were important limestone consumers.

Other crushed stones produced in Texas in 1954 were: Basalt (Uvalde County), used for concrete and road base; granite (Burnet County), used for riprap; marble (Travis County), used for terrazzo; sandstone (various counties), used principally by highway departments for concrete aggregate and road base. Miscellaneous stones (schist and rhyolite) were used for concrete aggregate, railroad ballast, and road base. Oystershell was recovered by dredging from reefs along the coasts of Texas and Louisiana. These shells have proved an excellent substitute for limestone to the expanding cement, lime, and chemical industries of the coastal areas, where no limestone deposits are known. Production in 1954 amounted to 10.3 million tons valued at $12.2 million. Most of the shell was used for concrete and road surfacing. Other important uses were for cement and lime.

Sulfur.—Most sulfur was recovered from salt domes by the Frasch process; a small quantity was obtained through purification of sour natural gas. Production and shipments in 1954 continued the decline begun 4 years before, but the State remained the principal producer in the Nation. Production was reported from 5 counties (Brazoria, Fort Bend, Jefferson, Liberty, and Wharton) by 5 producers. Operations were centered in eight domes: Boling, Clemens, Damon, Hoskins, Long Point, Moss Bluff, Nash, and Orchard.

Freeport Sulphur Co. began production at its new Nash Dome mine 35 miles southwest of Houston, 1 of 4 new sulfur projects undertaken by the company in the past several years. Standard Sulphur Co., a new organization in the industry, increased its Damon Mound sulfur capacity to 400 tons per day. A mobile plant adapted to the

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production problems of the deposit was used. The company planned to install a similar mobile plant at its Bryan dome in Brazoria County.

TABLE 22.—Sulfur produced and shipped from Frasch mines, 1945–49 (average) and 1950–54

Year	Production	Shipments		
		Long tons	Value	
			Total	Average per ton
1945–49 (average)	3,396,968	3,575,025	$61,681,909	$17.25
1950	3,949,164	(1)	(1)	(1)
1951	3,966,956	3,835,280	81,900,000	21.35
1952	3,784,595	3,691,724	78,910,000	21.37
1953	3,514,771	3,614,838	97,601,000	27.00
1954	3,505,087	3,474,477	92,791,821	26.71

[1] Figure withheld to avoid disclosure of individual company operations.

Talc and Soapstone.—The 1954 output of talc and soapstone in Texas was greater in both quantity and value than in 1953. Production was reported by two companies from Gillespie and Hudspeth Counties. The ground material was used principally in the ceramic and rubber industries and for insecticides and roofing granules.

Vermiculite (Exfoliated).—Crude vermiculite mined in other States was expanded at plants in three counties. The exfoliated product was used principally as a lightweight aggregate for plaster, for insulation, and as a soil conditioner.

Water.—Water, as a natural resource, has become a prerequisite to development of the State's tremendous natural endowment of minerals. Its development, use, and conservation are of vital concern to Texas industries. As demand increases, the supply becomes static or diminishes. The water problem will require understanding, sound management, and long-range planning for its solution. The problems of this vital commodity can be classified under industrial and domestic demands as they relate to ground-water and surface-water supply. Ground-water reserves were a major source of supply in the past but are being rapidly depleted as demand soars. Surface reserves in rivers and lakes are important in certain sections of the State and are gaining importance throughout the entire State. Surface-water reservoirs are now the principal source of water for most urban areas. Because of more extensive irrigation in west Texas and the High Plains and the increased number of ground-water wells, ground-water levels dropped alarmingly.

In view of the urgency of the State water problem, comprehensive programs were planned by Federal, State, and local agencies for developing an adequate supply. The interrelated nature of some of the problems can be demonstrated by considering the effects of rainfall. Heavy rainfall in the western part might relieve the supply problems in that region, but the resulting runoff could accentuate the problem of flood control in the eastern part or Gulf coast sections. Soil erosion and stream pollution from sediment load and industrial wastes were also important problems.

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REVIEW BY COUNTIES

Mineral production was reported in 233 of the 254 counties in Texas in 1954. The 10 leading counties, in order of mineral value, were: Ector, Brazoria, Gregg, Andrews, Scurry, Harris, Hutchinson, Rusk, Wharton, and Nueces.

Commodities impossible to designate as to county origin were as follows: Elemental sulfur, recovered at gasoline or cycling plants from gasfields other than the county in which the plant was situated; gem stones, because of the large number of hobbyists collecting the stones and the difficulty of assigning county origin to the source; crushed limestone and miscellaneous stone, produced by portable plants from several counties; and sand and gravel produced by portable plants from several counties. The value of this indeterminate production amounts to $681,000.

Anderson.—Mineral output in Anderson County consisted of crude oil, natural gas, and natural-gas liquids valued at $12.3 million. Crude-oil production of nearly 3 million barrels was reported from 12 oilfields, including 3 discovery fields. Four cycle plants recovered natural-gas liquids. Natural-gas production totaled 31.3 billion cubic feet.

Andrews.—Andrews County was the State's fourth-ranking producer of minerals, with $138.8 million in value. The 44.1 million barrels of crude oil produced from 108 oilfields included that from 23 discovery fields. Seven gasoline plants, including the new Midland Farms plant of Stanolind Oil & Gas Co., recovered natural-gas liquids. Division 6 of the Texas Highway Department produced crushed limestone for flexible road base and for concrete aggregate.

Angelina.—The Ginter field was the sole producer of crude oil in Angelina County. Bentonite used for drilling mud and for filtering and decolorizing oils was produced in 1954.

Aransas.—Crude oil valued at $10.1 million was produced from 52 fields, including 4 discovery fields. Natural gas was also produced. Heldenfels Bros. dredged oystershell from Copano Bay, and L. W. Richardson Construction Co. dredged from Aransas, Copano, St. Charles, and San Antonio Bays. The oystershell was used for aggregate in concrete and for road surfacing. Carbon black was recovered at the Kosmos "A" plant of United Carbon Co.

Archer.—Crude oil, natural gas, natural-gas liquids, and sand and gravel valued at more than $26 million were produced in Archer County in 1954. Eight oilfields were discovered. Two gasoline plants (the Chalk Hill of The Texas Co. and the Holliday plant of Warren Petroleum Corp.) recovered natural-gas liquids. The Texas Highway Department produced paving gravel for its road-maintenance program.

Atascosa.—Production of 3.9 million barrels of crude oil and 6.8 billion cubic feet of natural gas was reported in the county in 1954. Exploration projects of the oil industry resulted in the discovery of 12 new oilfields. Humble Oil & Refining Co. Jourdanton plant recovered natural-gas liquids. Espey Silica Sand Co. and West Land Silica Sand Co. produced glass, filter, and blast sands and sand for concrete.

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TABLE 23.—Value of mineral production in Texas, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value
Anderson	$11,183,044	$12,330,451	Petroleum, natural gas, natural-gas liquids.
Andrews	126,573,263	138,794,777	Petroleum, natural-gas liquids, natural gas, stone.
Angelina	749,204	478,390	Clays, petroleum.
Aransas	11,720,466	12,046,620	Petroleum, natural gas, stone.
Archer	27,488,801	26,129,660	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Atascosa	10,884,489	12,384,139	Petroleum, natural-gas liquids, sand and gravel, natural gas.
Austin	8,451,879	8,141,013	Petroleum, natural gas.
Bailey		300	Stone.
Bastrop	600,744	1,346,076	Clays, petroleum, natural gas.
Baylor	2,368,431	3,181,308	Petroleum, sand and gravel, natural gas.
Bee	13,486,659	14,497,177	Petroleum, natural-gas liquids, natural gas.
Bell	123,702	388,564	Sand and gravel, stone.
Bexar	8,790,573	12,601,366	Cement, stone, sand and gravel, clays, petroleum, natural gas.
Blanco		25,875	Stone.
Borden	21,724,470	17,199,607	Petroleum, natural gas.
Bosque		4,153	Stone.
Bowie	1,309,168	339,232	Sand and gravel, petroleum, natural gas.
Brazoria	155,010,611	162,411,241	Petroleum, natural gas, bromine, magnesium chloride, natural-gas liquids, Frasch sulfur, salt, magnesium compounds.
Brazos	58,250	20,842	Natural gas.
Brewster		61,310	Clays, sand and gravel.
Briscoe		98,034	Clays, stone, talc.
Brooks	20,752,754	20,247,991	Petroleum, natural-gas liquids, natural gas.
Brown	2,165,545	2,537,325	Petroleum, stone, clays, natural gas, sand and gravel.
Burleson	4,630	4,695	Petroleum.
Burnet		2,521,726	Stone, graphite, feldspar.
Caldwell	7,296,705	7,724,899	Petroleum.
Calhoun	7,999,688	9,342,380	Natural gas, petroleum, stone, sand and gravel.
Callahan	3,223,665	6,078,756	Petroleum, natural gas.
Cameron	288	338	Natural gas.
Camp	346,083	699,161	Petroleum, natural gas.
Carson	26,360,576	25,341,041	Natural gas, petroleum, natural-gas liquids.
Cass	2,206,058	2,444,256	Petroleum, iron ore, natural gas.
Chambers	59,423,709	62,877,694	Petroleum, stone, natural gas, natural-gas liquids.
Cherokee	2,158,584	2,750,723	Petroleum, iron ore, natural gas.
Childress		11,258	Sand and gravel.
Clay	14,450,912	16,042,060	Petroleum, natural gas.
Cochran	24,446,448	23,177,956	Do.
Coke	29,040,398	41,672,588	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Coleman	10,744,372	10,474,436	Petroleum, natural gas, sand and gravel, natural-gas liquids, clays.
Collin		7,389	Stone.
Collingsworth	171,567	159,432	Natural gas, petroleum.
Colorado	15,521,328	16,889,386	Natural gas, natural-gas liquids, sand and gravel, petroleum.
Comal	1,837,807	2,525,749	Stone, lime, sand and gravel.
Comanche	1,002,494	626,388	Petroleum, natural gas.
Concho	62,191	100,125	Do.
Cooke	23,655,907	22,357,769	Petroleum, natural-gas liquids, sand and gravel, natural gas.
Coryell		81,000	Stone.
Cottle		44,369	Sand and gravel.
Crane	55,185,886	60,178,909	Petroleum, natural gas, natural-gas liquids, sulfur, stone.
Crockett	24,179,054	25,358,238	Petroleum, natural gas.
Culberson	14,018	10,774	Sand and gravel, petroleum, natural gas.
Dallas	11,293,467	17,400,819	Cement, sand and gravel, stone, clays.
Dawson	6,625,673	7,804,847	Petroleum, stone, natural gas.
Denton	960,286	1,479,731	Petroleum, sand and gravel, clays.
De Witt	10,053,475	11,276,297	Petroleum, natural gas, natural-gas liquids, stone, sand and gravel.
Dickens	109,991	103,355	Petroleum, stone, pumicite, natural gas.
Dimmit	62,973	164,326	Petroleum.
Duval	36,050,276	38,870,310	Petroleum, natural gas, salt, natural-gas liquids.
Eastland	6,097,070	6,282,481	Petroleum, natural-gas liquids, natural gas, clays, sand and gravel.
Ector	181,257,423	166,513,053	Petroleum, natural-gas liquids, natural gas, recovered sulfur, stone.
Edwards	6,094	8,843	Petroleum, sand and gravel.
Ellis	90,334	209,127	Clays, petroleum.
El Paso	4,807,539	5,691,494	Cement, stone, sand and gravel, lime, clays.
Erath	191,349	164,679	Petroleum, natural gas, stone, sand and gravel.
Falls	54,692	35,317	Petroleum.
Fayette	2,195,878	2,266,051	Petroleum, clays, sand and gravel.

See footnotes at end of table.

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TABLE 23.—Value of mineral production in Texas, 1953–54, by counties [1]—Con.

County	1953	1954	Minerals produced in 1954 in order of value
Fisher	$14,495,812	$16,043,575	Petroleum, gypsum, natural gas.
Floyd	36,953	34,425	Sand and gravel, petroleum, natural gas.
Foard	187,265	234,311	Petroleum, natural gas.
Fort Bend	51,137,112	49,330,309	Petroleum, sulfur, natural gas, salt, clays, sand and gravel.
Franklin	12,801,678	13,072,254	Petroleum, natural gas.
Freestone	1,332,149	1,684,328	Natural gas, petroleum, sand and gravel.
Frio	8,301,182	10,514,401	Petroleum, natural-gas liquids, natural gas.
Gaines	54,311,306	56,603,778	Petroleum, natural gas, natural-gas liquids.
Galveston	27,741,475	28,362,908	Petroleum, natural gas.
Garza	10,532,786	12,282,856	Petroleum, sand and gravel, natural gas.
Gillespie	60,607	131,415	Sand and gravel, talc, stone, feldspar.
Glasscock	13,707,367	18,470,994	Petroleum, natural gas.
Goliad	10,592,277	11,095,304	Do.
Gonzales	368,746	145,765	Petroleum, sand and gravel, clays.
Gray	48,557,248	51,736,582	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Grayson	15,506,792	22,482,264	Petroleum, natural gas, sand and gravel.
Gregg	168,760,408	156,284,720	Petroleum, natural-gas liquids, natural gas.
Grimes	180,897	116,520	Petroleum, natural gas.
Guadalupe	9,924,629	11,067,671	Do.
Hale	7,320,949	6,651,294	Do.
Hall		2,129	Sand and gravel.
Hamilton	109,362	169,490	Natural gas, stone, sand and gravel, petroleum.
Hansford	5,289,470	5,474,722	Natural-gas liquids, natural gas, petroleum.
Hardeman	521,127	812,692	Gypsum, stone, natural-gas liquids, sand and gravel, petroleum.
Hardin	32,378,756	32,925,282	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Harris	106,584,382	107,292,344	Petroleum, cement, natural-gas liquids, natural gas, salt, lime, sand and gravel, clays, recovered sulfur.
Harrison	14,878,111	15,166,362	Natural gas, petroleum, natural-gas liquids, lignite, clays.
Hartley	1,760,910	2,546,868	Natural gas, petroleum.
Haskell	8,962,415	9,367,438	Petroleum, natural gas, sand and gravel.
Hays	1,238,030	1,416,012	Natural-gas liquids, sand and gravel.
Henderson	5,768,859	5,829,094	Petroleum, natural-gas liquids, natural gas, clays.
Hidalgo	8,903,300	9,129,796	Natural gas, natural-gas liquids, petroleum, sand and gravel, stone, clays.
Hill		728	Sand and gravel, petroleum.
Hockley	55,506,600	48,778,448	Petroleum, natural-gas liquids, natural gas, recovered sulfur.
Hood		3,887	Sand and gravel.
Hopkins	7,904,412	7,974,559	Petroleum, natural-gas liquids, natural gas.
Houston	3,287,161	4,068,479	Do.
Howard	34,020,294	40,016,236	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Hudspeth	240,368	463,817	Stone, talc, gypsum, silver.
Hunt	123,240	3,200,221	Natural gas, petroleum.
Hutchinson	95,686,543	97,338,943	Natural-gas liquids, petroleum, natural gas, sand and gravel.
Irion	252,455	167,864	Petroleum, natural gas.
Jack	20,805,835	20,854,754	Petroleum, natural gas, stone, sand and gravel.
Jackson	40,149,568	36,436,039	Petroleum, natural gas, natural-gas liquids, sand and gravel.
Jasper	492,747	1,016,715	Petroleum, natural gas, clays.
Jeff Davis		13,500	Sand and gravel, stone.
Jefferson	34,964,195	42,978,747	Petroleum, Frasch sulfur, natural gas, stone, sand and gravel.
Jim Hogg	5,789,065	4,924,651	Petroleum, natural-gas liquids, natural gas.
Jim Wells	55,366,800	53,807,066	Petroleum, natural gas, natural-gas liquids.
Johnson	195,736	625,581	Lime, stone, sand and gravel.
Jones	22,795,325	23,147,333	Petroleum, sand and gravel, stone, natural gas.
Karnes	7,023,920	6,884,438	Petroleum, natural-gas liquids, natural gas.
Kaufman	4,350,458	3,861,919	Petroleum, stone, natural gas.
Kendall		840	Sand and gravel.
Kenedy	539,020	744,190	Petroleum, natural gas.
Kent	17,658,023	19,027,674	Do.
Kerr		5,000	Sand and gravel, petroleum.
Kimble		8,922	Petroleum.
King	3,774,999	3,370,160	Petroleum, natural gas.
Kleberg	8,188,276	8,147,489	Petroleum, natural gas, stone.
Knox	3,368,965	3,120,703	Do.
Lamar		14,034	Sand and gravel.
Lamb	8,879	213,663	Petroleum, natural gas.
La Salle	187,630	274,650	Do.
Lavaca	5,901,718	5,779,285	Natural gas, petroleum, sand and gravel.
Lee	41,111	19,835	Peat, petroleum.
Leon	2,393,736	2,290,750	Natural gas, petroleum.

See footnotes at end of table.

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TABLE 23.—Value of mineral production in Texas, 1953–54, by counties [1]—Con.

County	1953	1954	Minerals produced in 1954 in order of value
Liberty	$41,099,064	$47,890,800	Petroleum, frasch sulfur, natural gas, sand and gravel, natural-gas liquids.
Limestone	1,492,025	1,649,990	Petroleum, natural gas, stone, sand and gravel.
Live Oak	4,976,273	7,064,908	Natural gas, petroleum, sand and gravel.
Llano	598,887	76,435	Stone, feldspar.
Loving	4,076,900	4,731,083	Petroleum, natural gas, stone.
Lubbock	676,844	1,363,819	Petroleum, sand and gravel, natural gas.
Lynn	398,036	325,608	Petroleum, natural gas.
Madison	312,715	752,801	Natural gas, petroleum.
Marion	3,182,801	4,140,906	Petroleum, natural gas, natural-gas liquids.
Martin	1,488,002	2,168,271	Petroleum, stone, natural gas.
Mason		18,678	Stone.
Matagorda	28,289,052	28,965,368	Petroleum, natural gas, natural-gas liquids, stone.
Maverick		10,026	Natural gas.
McCulloch	4,066	8,305	Petroleum, sand and gravel.
McLennan	2,445,477	3,136,159	Cement, sand and gravel, stone, clays, petroleum.
McMullen	2,535,777	3,210,726	Petroleum, natural gas.
Medina	48,116	71,960	Petroleum, clays.
Menard		972	Petroleum.
Midland	32,217,035	48,921,234	Petroleum, natural gas, natural-gas liquids, stone.
Milam	127,229	2,534,576	Lignite, petroleum, natural gas, sand and gravel.
Mitchell	2,411,236	3,427,286	Petroleum, sand and gravel, natural gas.
Montague	27,880,104	26,621,841	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Montgomery	41,330,958	39,280,953	Petroleum, natural-gas liquids, natural gas.
Moore	29,602,246	36,968,968	Natural gas, natural-gas liquids, helium, recovered helium, recovered sulfur, petroleum.
Morris		5,132,234	Iron ore.
Motley		3,023	Sand and gravel.
Nacogdoches	1,173,285	1,655,984	Natural gas, clays, petroleum.
Navarro	4,436,837	6,509,520	Petroleum, clays, natural gas.
Newton	3,444,303	3,217,475	Petroleum, natural gas.
Nolan	11,641,302	20,856,572	Petroleum, cement, gypsum, stone, natural gas, clays, sand and gravel.
Nueces	74,996,609	77,179,837	Petroleum, natural gas, natural-gas liquids, cement, lime, stone, sand and gravel, clays.
Ochiltree	94,336	105,786	Petroleum, natural gas.
Oldham		372,437	Sand and gravel, natural gas.
Orange	15,706,373	16,686,199	Petroleum, natural gas.
Palo Pinto	1,700,635	1,548,165	Petroleum, natural-gas liquids, natural gas, clays, sand and gravel.
Panola	58,136,771	57,499,040	Natural gas, natural-gas liquids, petroleum.
Parker	1,308,274	1,396,178	Natural-gas liquids, clays, petroleum, stone, natural gas, sand and gravel.
Pecos	55,090,483	50,769,689	Petroleum, natural gas, sand and gravel.
Polk	6,065,402	6,209,202	Petroleum, natural gas, sand and gravel, stone.
Potter	5,004,277	7,494,994	Natural gas, sand and gravel, natural-gas liquids, helium, stone, petroleum.
Presidio		90	Silver.
Reagan	20,754,721	36,984,985	Petroleum, natural gas, natural-gas liquids.
Real		11,542	Sand and gravel.
Red River	17,113	19,533	Petroleum.
Reeves	2,388,869	1,303,208	Petroleum, sand and gravel, natural gas, stone.
Refugio	64,468,514	62,929,197	Petroleum, natural gas, natural-gas liquids.
Roberts	2,034,683	4,352,622	Petroleum, natural gas.
Robertson		605,248	Sand and gravel, petroleum, natural gas.
Rockwall		39,298	Stone.
Runnels	25,745,645	19,057,156	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Rusk	98,457,874	92,279,407	Petroleum, natural-gas liquids, natural gas, clays.
San Jacinto	2,555,824	2,522,430	Petroleum, natural gas, sand and gravel.
San Patricio	56,590,598	54,821,362	Petroleum, natural gas, natural-gas liquids, sand and gravel, stone.
Schleicher	9,107,917	9,331,414	Petroleum, natural gas.
Scurry	144,095,693	119,774,075	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Shackelford	6,432,953	7,533,946	Petroleum, natural gas, natural-gas liquids, sand and gravel, pumicite.
Shelby	1,460,959	1,837,140	Natural gas, petroleum.
Sherman	9,767,228	10,010,291	Do.
Smith	8,133,513	8,253,826	Natural-gas liquids, petroleum, natural gas, clays sand and gravel.
Somervell		998	Sand and gravel.
Starr	24,995,940	24,580,252	Petroleum, natural gas, natural-gas liquids, pumicite.
Stephens	11,919,460	12,251,100	Petroleum, natural-gas liquids, natural gas.
Sterling	1,340,376	1,746,340	Petroleum, natural gas.
Stonewall	20,396,456	23,169,450	Do.
Sutton	446,283	441,751	Natural gas, petroleum.

See footnotes at end of table.

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TABLE 23.—Value of mineral production in Texas, 1953–54, by counties [1]—Con.

County	1953	1954	Minerals produced in 1954 in order of value
Tarrant	$6,030,293	$7,175,773	Cement, sand and gravel, recovered sulfur, clays, stone.
Taylor	4,571,962	5,172,185	Petroleum, sand and gravel, natural-gas liquids, clays, natural gas.
Terrell		52,076	Stone.
Terry	16,192,664	16,707,524	Petroleum, natural gas.
Throckmorton	8,547,082	9,307,590	Petroleum, natural gas, sand and gravel.
Titus	14,056,230	11,840,719	Petroleum, natural gas.
Tom Green	3,200,547	4,305,501	Petroleum, natural-gas liquids, sand and gravel, natural gas.
Travis	2,067,426	3,022,926	Stone, lime, sand and gravel, petroleum, abrasives.
Trinity		31,549	Clay, natural gas.
Tyler	2,113,863	2,611,511	Petroleum, natural gas.
Upshur	10,635,155	9,682,643	Petroleum, natural gas, sand and gravel.
Upton	66,344,759	58,301,367	Petroleum, natural-gas liquids, natural gas, stone.
Uvalde	1,026,826	2,160,014	Asphalt, basalt.
Val Verde		600	Sand and gravel.
Van Zandt	32,938,179	29,086,384	Petroleum, salt, natural-gas liquids, natural gas.
Victoria	29,851,158	29,326,148	Petroleum, natural gas, sand and gravel, natural-gas liquids.
Walker	590,521	527,957	Clays, petroleum.
Waller	1,226,809	1,141,989	Petroleum, natural gas, sand and gravel.
Ward	30,922,297	31,900,765	Petroleum, natural gas, natural-gas liquids, natural salines, sand and gravel.
Washington	1,253,040	936,189	Petroleum, natural gas.
Webb	6,069,630	6,175,823	Petroleum, natural gas, sand and gravel.
Wharton	92,729,808	80,775,009	Sulfur, petroleum, natural gas, sand and gravel.
Wheeler	6,883,208	6,649,805	Petroleum, natural-gas liquids, natural gas.
Wichita	37,751,780	38,179,664	Petroleum, natural-gas liquids, natural gas, stone, sand and gravel.
Wilbarger	9,769,750	11,954,146	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Willacy	9,114,190	8,249,828	Petroleum, natural gas.
Williamson	644,627	982,527	Stone, lime, petroleum, sand and gravel.
Wilson	882,564	4,146,556	Natural gas, petroleum, clays.
Winkler	49,487,318	46,687,215	Petroleum, natural-gas liquids, natural gas, recovered sulfur.
Wise	3,626,178	4,430,791	Stone, petroleum, natural-gas liquids, natural gas, clays, sand and gravel.
Wood	75,938,928	68,720,913	Petroleum, natural-gas liquids, natural gas.
Yoakum	59,054,968	56,214,197	Petroleum, natural-gas liquids, natural gas, salt.
Young	16,988,035	18,484,405	Petroleum, natural-gas liquids, natural gas, sand and gravel.
Zapata	1,948,949	2,578,887	Petroleum, natural gas.
Zavala	144,521	133,590	Natural gas, sand and gravel, petroleum.
Undistributed		6,502,808	
Total	3,647,913,000	[2] 3,730,162,000	

[1] The following counties are not listed because no production was reported: Armstrong, Bandera, Castro, Crosby, Dallam, Deaf Smith, Delta, Donley, Fannin, Hemphill, Kinney, Lampasas, Lipscomb, Mills, Parmer, Rains, Randall, Sabine, San Augustine, San Saba, and Swisher.
[2] The total value has been adjusted to eliminate duplication in value of clays and stone.

Austin.—Austin County reported crude-oil production from eight fields and a significant quantity of natural gas. No new discoveries in oil or gas were reported in 1954.

Bailey.—Bailey County Highway Department reported production of miscellaneous stone (caliche) for road maintenance.

Bastrop.—Crude oil, from 10 fields, and natural gas were produced in 1954. No new oilfield discoveries were reported. Elgin-Standard Brick Mfg. Co. and Elgin-Butler Brick Co. used fire clay for building brick and heavy clay products.

Baylor.—Crude oil and natural gas were the principal mineral products in Baylor County; 17 oilfields, including 3 discoveries, reported output. Gravel for road surfacing was produced by the Texas Highway Department.

Bee.—Mineral fuels having a value exceeding $14 million were reported from Bee County. One new oilfield (the Cosden West

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(Hockley Upper)) was discovered in 1954. Stanolind Oil & Gas Co. and Gasoline Production Corp. operated cycling plants at Pettus. Danaho Refining Co. began a $2.7 million expansion program at its Pettus refinery, with construction of a new platforming unit. This unit will add 1,000 barrels per day to the refinery cracked-gasoline capacity.

Bell.—The Texas Highway Department produced paving sand for its road program. Sand and gravel for use in concrete was produced by Belton Sand & Gravel Co. and Little River Gravel Co.

Bexar.—A new industry was begun in Bexar County with construction of a plant to manufacture lithium chemicals. The new company (American Lithium Chemicals, Inc., a subsidiary of American Potash & Chemical Corp.) will process lithium ores from Southern Rhodesia. Longhorn Portland Cement Co. and San Antonio Portland Cement Co. manufactured cement from limestone and clay mined in the county. There were 11 sand and gravel producers in the county whose products were used principally for building and paving purposes. There were 7 stone producers in the county in 1954; 6 producers quarried limestone, used mostly for manufacturing cement and as an aggregate for concrete; 1 producer reported output of miscellaneous stone as an aggregate for concrete. Alamo Clay Products Co. mined fire clay used to manufacture heavy clay products. Other clay producers were the Southern Co. and J. Camper & Son. Crude oil was produced from eight oilfields.

Blanco.—The Texas Highway Department quarried and crushed limestone for aggregate in concrete and for flexible road base.

Borden.—Crude oil and natural gas valued at over $17 million were produced in Borden County in 1954. Twenty-four fields supplied crude-oil production, 9 of which were discoveries. Two of the established oilfields—the Good and the Reinecke—each produced over 1 million barrels of crude during the year.

Bosque.—The Texas Highway Department produced crushed limestone as flexible road-base material and for aggregate in concrete.

Bowie.—Crude oil, natural gas, and sand and gravel valued at $339 thousand was reported from Bowie County in 1954. Crude oil was produced from the Dalby Springs and the Eylau fields. Sand and gravel for building and paving purposes was produced in the county.

Brazoria.—Brazoria County was the second ranking county in mineral value, with a total of $162 million. Minerals produced were: Bromine, crude oil, magnesium compounds, magnesium chloride used for metal, natural gas, natural-gas liquids, carbon black, salt, and sulfur. Mineral processing and extractive plants consisted of 2 oil refineries, 4 natural-gasoline plants, 1 carbon-black plant, and 2 magnesium smelters. Crude oil was produced from 51 fields, including 9 discovery fields. Five oilfields produced over 1 million barrels. Phillips Petroleum Co. operated a 79-thousand-barrel-per-day oil refinery at Sweeney. The county had four gasoline plants—the Bayou plant of Phillips Petroleum Co., the Pledger plant of Southern Production Co., Inc., and the Hastings and Old Ocean plants of Stanolind Oil & Gas Co. Carbon black was produced by Peerless Carbon Black Co. at its Sweeney roller plant 2½ miles east of Sweeney. Dow Chemical Co. operated its magnesium plant at Freeport, as well as the

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Government-owned plant at Velasco. The Velasco plant was leased from the Government for another 3 years. Native sulfur was mined by the Frasch process by Freeport Sulphur Co. at its Hoskins Mound and by Jefferson Lake Sulphur Co. at its Clemens dome. A third producer, Standard Sulphur Co., began production at its Damon Mound property near Rosenburg. The company utilized a mobile plant modified for production operations. Salt brine from wells was used by Dow Chemical Co. at its magnesium-reduction works.

Brewster.—Clay and sand and gravel were produced in Brewster County in 1954. Exploration for mercury was reported for the first time in several years from the Terlingua area of the Big Bend country. Division 24 of the Texas Highway Department produced paving gravel for its road maintenance program. Soyl-Aid, Inc., produced a carbonaceous shale as a soil conditioner and an agricultural mineral.

Briscoe.—Fuller's earth used as a filtering medium and for decolorizing oil was mined by Silverton Clay Products Co. from pits 8 miles west of Silverton. The Texas Highway Department produced crushed sandstone as an aggregate in concrete and for road surfacing.

Brooks.—Crude oil, natural gas, and natural-gas liquids with a combined value exceeding $20 million were reported from Brooks County in 1954. Over 4 million barrels of crude oil was produced from 36 oilfields, of which seven were new discoveries in 1954. United Carbon Co., Inc., operated its Dixie carbon-black plant throughout the year.

Brown.—Texas Brick Co. mined shale for use in building brick and heavy clay products. Ross & Son Construction Co. produced sand and gravel for building and paving purposes. G. C. McBride Co. quarried and crushed limestone for use as an aggregate in concrete, for riprap, and for railroad ballast. The Rising Star gasoline plant of Rudco Oil & Gas Co. stripped natural-gas liquids from gasfields in surrounding counties.

Burleson.—Crude oil was produced from the Chriesman field, the county's only oil producer in 1954. No crude-oil discoveries were made in the county during the year.

Burnet.—Dressed architectural and monumental granite was produced by Texas Pink Granite Corp. from its quarry 1½ miles west of Marble Falls. Houston, Clinton & Co. produced crushed limestone for riprap, railroad ballast, and road metal and as an aggregate for concrete. Feldspar was mined from an open pit about 3 miles from Kingsland by Dezendorf Marble Co. The material was ground at the company mill and marketed as roofing material. The Southwestern Graphite Co. plant at Burnet was shut down the first of the year because of poor markets. This plant was capable of producing 25 percent of the Nation's requirements for flake graphite. Although the plant was idle, shipments of flake graphite were made from stock. Texas Vermiculite Co. expanded vermiculite, mined in other Western States, for use as an insulating filler.

Caldwell.—Crude oil valued at nearly $8 million was reported from Caldwell County in 1954. Production came from 13 fields, with the Luling Branyon field furnishing 2.4 million barrels.

Calhoun.—Oystershell was dredged from the several bays along the Calhoun County Gulf coast by Smith Bros. Dredging Co. and Bauer-Smith Dredging Co. The shell was used for making lime, as an

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aggregate for concrete, and for road surfacing. Division 13 of the Texas Highway Department used beach sand for its road-maintenance program. Aluminum Co. of America operated its Point Comfort reduction works at near capacity in 1954. The company plans to add 20,000 tons to the existing 90,000 tons annual capacity during 1955. Over 1.5 million barrels of crude oil and over 50 billion cubic feet of natural gas were produced in the county in 1954. Natural-gas liquids were recovered at the Heyser gasoline plant of Humble Oil & Refining Co.

Callahan.—Premier Oil & Refining Co. operated its Baird refinery at near capacity. Over 2 million barrels of crude oil and 155 million cubic feet of natural gas were reported from Callahan County in 1954. This output was valued at over $6 million. Sixty oilfields supplied crude output, including 26 discovery fields.

Cameron.—The Port Isabel refinery of Taylor-Mayfair Co. and the Brownsville refinery of Port Fuel Co. operated at near capacity throughout 1954. Stanolind Oil & Gas Co. rehabilitated the idle gas-synthesis plant formerly owned by Carthage Hydrocol, Inc. Production was begun late in 1954. About 6 million cubic feet of natural gas was the only mineral fuel reported in the county in 1954. Magcobar Co. ground and processed imported barite for use in heavy drilling muds.

Camp.—Crude oil and natural gas valued at nearly $700 thousand were reported from Camp County in 1954. The crude-oil production came from three established fields; no new discoveries were reported.

Carson.—Mineral fuels valued at more than $25 million were reported from Carson County, 1954. Over 3 million barrels of crude oil and 139 billion cubic feet of natural gas were produced during the year. The Carson Co. field furnished all of the crude production. Natural-gas liquids were recovered at three gasoline plants—the Cargrays plant of Dorchester Corp., the Bryan No. 17 plant of Shell Oil Co., and the Schafer plant of Skelly Oil Co. Carbon black was produced at the Schafer channel plant of Cabot Carbon Co.

Cass.—Brown iron ore was mined from open pits of Sheffield Steel Co. in Cass County. The ore was trucked to the new company beneficiation plant, which upgraded the ore for use in the company blast furnaces in Houston.[7] Crude oil and natural gas valued at nearly $2 million were also reported produced in the county. Natural-gas liquids were recovered at the Lodi gasoline plant of Breckenridge Gasoline Co.

Chambers.—Chambers County reported output of crude oil, natural gas, natural-gas liquids, and oystershell valued at nearly $63 million. The county ranked 12th in mineral value reported in Texas. Oystershell was dredged from Galveston and Trinity Bay, Chambers County, by Parker Bros. & Co., by W. D. Haden Co., and by Horton & Horton Co. The oystershell was used for aggregate in concrete, for road surfacing, and for lime manufacture. Natural-gas liquids were recovered at the Anahuac gasoline plant of Humble Oil & Refining Co. Crude-oil production was reported from 35 fields, including 2 discovery fields. Four fields in Chambers County each

[7] Lloyd, C. Leonard, Jr., How Sheffield's Beneficiation Plant Upgrades Texas Iron Ores: Eng. Min. Jour., vol. 155, No. 11. November 1954, pp 98-100.

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had production greater than 1 million barrels: Anahuac, Barbers Hill, Oyster Bayou, and Winnie North.

Cherokee.—Sheffield Steel Co. mined brown iron ore at its Rusk and Mount Haven open pits in Cherokee County. The ore was transported by a fleet of 7-yard Mack diesel-powered trucks to the new company mill, where the ore was upgraded. Crude oil and natural gas were also produced.

Childress.—Gravel used as an aggregate in concrete and for road surfacing was produced by the Texas Highway Department. This was the only mineral commodity reported from Childress County in 1954.

Clay.—Crude oil and natural gas valued in excess of $16 million were reported from Clay County in 1954. Crude oil was produced from 74 fields, 9 of which were discovery fields. The Ringgold gasoline plant of Otha H. Grimes produced natural-gas liquids.

Cochran.—Cochran County reported 7.9 million barrels of crude oil and 9 billion cubic feet of natural gas valued at $23 million in 1954. Crude was produced from 9 oilfields, with the Levelland field supplying 95 percent of the total production. One oilfield discovery, the Cochran (San Andres), was brought in on June 30, 1954.

Coke.—Crude oil, natural gas, and natural-gas liquids supplied most of the $41.7 million mineral value from Coke County in 1954. Natural-gas liquids were recovered at the Jameson gasoline plant of Sun Oil Co. This company completed an expansion program initiated several years before, which boosted the daily plant capacity to 50 billion cubic feet of gas. The plant, which is 1 mile south of Silver, strips gasoline from the Jameson-Strawn Sand field. There were 13.4 million barrels of crude oil and 22 billion cubic feet of gas produced in the county in 1954.

Coleman.—Sand and gravel used for building and paving purposes and for railroad ballast was produced by Robert Lee Sand & Gravel Co. and by Cecil Montgomery. Santa Anna Silica Sand Co. produced glass, molding, and blast sands near Santa Anna. Martin Brick Co. mined clay for use as building brick and heavy clay products. Production of 3.3 million barrels of crude oil, 5.6 billion cubic feet of natural gas, and natural-gas liquids recovered from 5 gasoline plants supplied most of the $10.5 million value reported from Coleman County in 1954. One new gasoline plant, the $500,000 Andrew M. Howsley plant of the Glen Cove field, went on stream in May 1954.

Collin.—Division 18 of the Texas Highway Department reported production of crushed limestone used in its road maintenance program as aggregate for concrete and for road surfacing.

Collingsworth.—Crude oil and natural gas valued at $159,000 were reported from Collingsworth County in 1954. All of the crude production came from the Collingsworth County field.

Colorado.—Minerals produced in Colorado County in 1954 were valued at $16.9 million. The mineral fuels—crude oil, natural gas, natural-gas liquids—furnished most of this value. Twenty oilfields reported production during the year. Sand and gravel used for building and paving purposes was reported by five producers. Horton & Horton operated a portable gravel plant near Columbus and a fixed plant near Eagle Lake. Parker Bros. & Co., Inc., operated a portable

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plant near Columbus. Texas Construction Materials Co. operated 2 portable plants—1 near Eagle Lake and the other near Columbus—and a fixed plant near Columbus. Thorstenberg & Tamborello operated portable plants near Eagle Lake and Columbus and a fixed plant near Eagle Lake. Such speciality sands as molding sand, metallurgical flux, and engine sand were also produced. Natural-gas liquids were recovered at the Chesterville gasoline plant of Tennessee Production Co. and at the Sheridan cycling plant of Shell Oil Co. Division 13 of the Texas Highway Department produced some paving gravel.

Comal.—Stone, sand and gravel, and lime valued at $2.5 million were reported from Comal County in 1954. Erhardt Kraft produced building and paving sand and gravel. Crushed limestone used for riprap, metallurgical flux, aggregate for concrete, railroad ballast, and manufacturing lime was reported by two producers. Lime, used for building and chemical purposes, was produced in the county in 1954.

Comanche.—Crude oil and natural gas valued at over $600,000 were reported from Comanche County in 1954. Crude-oil production came from seven established fields.

Concho.—Concho County reported crude oil and natural gas valued at $100,000 in 1954. Crude oil was produced from six established fields.

Cooke.—Mineral production in Cooke County in 1954 amounted to $22.4 million, consisting of crude oil, natural gas, natural-gas liquids, and sand and gravel. There were 2 gasoline plants and 1 refinery within the county. Natural-gas liquids were recovered at the Sivells Bend gasoline plant of Standard Oil Co. of Texas and the Walnut Bend plant of Texas Natural Gasoline Corp. Tydol Co. operated its refinery at Gainesville. Crude oil was produced from 57 oilfields; 14 fields were new discoveries. Cooke County and Walnut Bend fields each produced over 1 million barrels of crude oil in 1954. Gravel was produced by the Texas Highway Department for use in paving.

Coryell.—Crushed limestone used for aggregate in concrete and for road paving was produced by Division 9 of the Texas Highway Department—the only mineral commodity reported for the county in 1954.

Cottle.—Sand and gravel for paving and road maintenance was produced in Cottle County by Childress Sand & Gravel Co. and the Texas Highway Department.

Crane.—Crane County, with a total mineral-output value of $60.2 million, ranked 14th in the State as a mineral producer in 1954; mineral commodities included sulfur recovered from sour natural gas, crushed limestone, crude oil, natural gas, and natural-gas liquids. Natural-gas liquids were recovered at the Wadell gasoline plant of Gulf Oil Corp. and at the Crane plant of Phillips Petroleum Co.; each of these plants recovered sulfur by the Modified Claus process. Division 6 of the Texas Highway Department produced crushed limestone for flexible base and road surfacing. In 1954 19.5 million barrels of crude oil and 32 billion cubic feet of gas were produced in the county.

Crockett.—Crude oil and natural gas valued at $25.4 million were reported from Crockett County in 1954. There were 49 producing oilfields in the county, of which 6 were new discoveries in 1954.

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Culberson.—Division 24 of the Texas Highway Department produced gravel for paving purposes. Crude oil and natural gas were produced during the year.

Dallas.—Minerals valued at more than $17.4 million were produced in Dallas County in 1954. Portland cement was produced at the Dallas plant of Lone Star Cement Corp. and at the Eagle Ford Nos. 1 and 2 plants of Trinity Portland Cement Division of General Portland Cement Co. Cement-production facilities at Eagle Ford plant No. 2 were expanded 1.25 million barrels; the new equipment included a 425-foot kiln and additional grinding facilities. Ferris Brick Co. mined miscellaneous clay in its open pit for use in manufacturing heavy-clay products. Shale was mined and processed by General Portland Cement Co. at its No. 2 plant. Structural and paving sand and gravel were produced by 22 operators in Dallas County. Limestone used to manufacture cement was quarried and crushed by Lone Star Cement Co. and General Portland Cement Co. Perlite from Western States was expanded for use as insulating filler and as a lightweight aggregate in plaster and cement. Texas Vermiculite Co. expanded vermiculite from Western States for use as insulation.

Dawson.—Crude oil and natural gas valued at nearly $8 million were reported from Dawson County in 1954. Seventeen oilfields, including 3 discovery fields, furnished the crude output. The Welch oilfield produced over 1 million barrels of crude in 1954.

Denton.—Denton County produced crude oil, clay, and sand and gravel valued in excess of $1 million in 1954. Crude-oil production was reported from five established fields. Acme Brick Co. mined plastic fire clay for manufacturing brick and heavy clay products. Sand and gravel used as an aggregate in concrete for building and paving purposes was reported by four producers in 1954.

De Witt.—Crude-oil production amounted to more than 2.9 million barrels from 17 oilfields, 2 of which were new discoveries in 1954. Over 21 billion cubic feet of natural gas was produced during the year. Natural-gas liquids were recovered from the Gohlke gasoline plant of Shell Oil Co. and the Nordheim cycling plant of Wescol Oil & Gas Co. Division 13 of the Texas Highway Department produced crushed sandstone, miscellaneous stone (caliche), and paving gravel for its road maintenance program.

Dickens.—Caprock Chemical Co., Inc., prepared pumicite as a filler for disinfectant floorsweep at its plant near McAdoo. Division 13 of the Texas Highway Department quarried sandstone for use as a flexible road base and as surfacing material in its 1954 highway program. Crude oil and natural gas were also produced in the county.

Dimmit.—Crude oil valued at $164 thousand was reported from Dimmit County in 1954. Production was reported in five oilfields, including the Wintergarden (Olmos Third Sand), a new discovery.

Duval.—Production of 11.8 million barrels of crude oil was reported from 110 fields, including 7 discovery fields, as well as 46.6 billion cubic feet of natural gas in Duval County in 1954. Four oilfields—Seven Sisters, Piedre Lumbre, Hoffman, and Government Wells, North—each reported production exceeding 1 million barrels. Natural-gas liquids were recovered at the Duval gasoline plant and the Duval cycling plant of Duval Gasoline Co., the Hagist plant of Goliad Corp., and the Sejita cycling plant of Trinity Gas Corp. Salt brine

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was produced by Columbia Southern Chemical Corp. for use in its chemical processes.

Eastland.—Natural-gas liquids were recovered from five gasoline plants—the Consolidated plant of Ibex Co., the Pueblo plant of Lone Star Gas Co., plant No. 108 of Lone Star Producing Co., the Desdemona plant of Magnolia Petroleum Co., and the Pioneer gasoline plant of Ike-Rudman and Pioneer Gasoline Co. Crude oil and natural gas valued at more than $3 million were also reported. Hart Bros. produced building and paving sands during the year.

Ector.—Ector County was the leading mineral-producing county in Texas in 1954, with minerals valued at more than $166 million. Natural-gas liquids were recovered at five gasoline plants—the Odessa plant of Odessa Natural Gasoline Co., the Goldsmith and Judkins plants of Phillips Petroleum Co., the TXL plant of Shell Oil Co., and the North Cowden plant of Stanolind Oil & Gas Co. Texas Gulf Producing Co. built a gasoline plant 4 miles north of Odessa to strip the natural gas from its new Headlee field. Three of the gasoline plants (Odessa, Goldsmith, and North Cowden) recovered elemental sulfur. Sid W. Richardson Carbon Co. also produced carbon black at its Odessa A, B, and C plants. Division 6 of the Texas Highway Department quarried and crushed limestone for use as an aggregate in concrete and as a flexible road-base material. Twelve new oil-field discoveries were made in 1954. The county has 11 fields that produced over 1 million barrels of oil during the year: The Andector (Ellenburger), Cowden (North), Cowden (South), Foster, Goldsmith, Goldsmith (Clearfork), Goldsmith (5,600 feet), Headlee (Ellenburger), Jordan (Ellenburger), TXL (Devonian), TXL (Ellenburger), Yarbrough, and Allen.

Edwards.—Gravel for paving and road maintenance was produced by Division 22 of the Texas Highway Department. Some crude oil was also produced in the county in 1954.

Ellis.—Barron Brick Co., Acme Brick Co., and Ferris Brick Co. mined fire clay by open-pit methods for manufacturing face brick and heavy clay products. Some crude oil was produced in the county during the year.

El Paso.—Lime, cement, clay, sand and gravel, and limestone were produced in El Paso County in 1954. American Smelting & Refining Co. smelted ores and concentrates of copper and lead and Phelps Dodge Corp. refined blister copper from its Deming, N. Mex., smelter. Standard Oil Co. of Texas and The Texas Co. each operated an oil refinery in the city of El Paso during the year. Portland cement was produced at the El Paso plant of Southwestern Portland Cement Co. Lime was produced by Atlas Building Products Co. and El Paso Building Materials Co. for use in the building and chemical industries. Crushed limestone used as an aggregate in concrete, for road surfacing, and in manufacturing cement and lime was reported by five producers. Division 24 of the Texas Highway Department produced a small quantity of crushed limestone for road surfacing. Sand and gravel for building and paving purposes and for engine sand were reported by Bowden Sand & Gravel Co., El Paso Sand Products Co., and Vowell Materials Co. Clays used for manufacturing cement were also produced in the county during 1954. El Paso Perlite Co., Inc., expanded perlite mined in other Western States.

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Erath.—Division 2 of the Texas Highway Department produced gravel and crushed limestone for paving and road surfacing. There were 29 thousand barrels of crude oil and 702 million cubic feet of natural gas produced during the year.

Falls.—Crude oil amounting to 12,000 barrels was produced from 4 established oilfields during 1954.

Fayette.—Thorstenberg & Tamborello produced building and paving sand and gravel from plants near LaGrange and Fayetteville. Bentonitic clays were mined and milled by Baroid Sales Division, National Lead Co., at Muldoon and by Milwhite Co., Inc., at Flatonia, Fayette County. Flatonia Fuller's Earth Co. mined fuller's earth near Weaver. The county produced 339,000 barrels of crude oil from 15 fields; the Julie Ann (Armin-B-Sand) and the Julie Ann (Lower Steinhauser) were discovery fields.

Fisher.—Gypsum was mined by Celotex Corp. at pits near Hamlin and Longworth and by National Gypsum Co. from pits north of Rotan. Crude oil and natural gas valued at $14.7 million were produced in 1954. The crude oil originated from 45 fields, 6 of which were new discoveries in 1954. One oilfield—Round Top (Palo Pinto Reef)—produced 1.5 million barrels of crude during the year.

Floyd.—Sand and gravel for building and paving purposes was produced by Quitaque Sand & Gravel Co. Crude oil was produced from two established fields during the year. Nearly 3 million cubic feet of natural gas was reported during the year.

Foard.—Crude oil was produced from 3 fields, output being about 78,000 barrels of crude; 119 million cubic feet of natural gas was produced in 1954.

Fort Bend.—Minerals valued at $49.3 million were reported from Fort Bend County in 1954. Sulfur was mined by the Frasch process from three domes, the Orchard dome, by Duval Sulphur & Potash Co., the Long Point dome, by Lone Star Sulphur Corp., Jefferson Lake Sulphur Co., and Texas Gulf Sulphur Co.; and the Nash dome, by Freeport Sulphur Co. The Nash dome operation of Freeport Sulphur was new, production beginning in the first quarter of the year. Evaporated salt was produced by Gulf Salt Co. Paving gravel was produced by Division 12 of the Texas Highway Department and by the Fort Bend County Highway Department. The Texas Industries, Inc., produced lightweight aggregate from shale mined in the county. Russell Engineering Corp. operated its Clodine gasoline plant. The output of 11.7 million barrels of crude oil and 30 billion cubic feet of natural gas was reported from the county in 1954. There was one new oilfield discovery during the year.

Franklin.—There were 4.5 million barrels of crude oil and 602 million cubic feet of natural gas produced during the year. Five oilfields supplied the crude production; New Hope (Bacon Lime) and Talco fields on the Franklin-Titus County line each produced over 1 million barrels during the year.

Freestone.—Molding sand was produced by the Corley Estate. Crude oil and natural gas valued at $1.6 million were produced during the year. Four oilfields furnished the crude-oil production; Steward's Mill (Woodbine) field was a discovery.

Frio.—Production of mineral fuels valued at $10.5 million, consisting of crude oil, natural gas, and natural-gas liquids was reported from

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Frio County in 1954. The oil industry produced crude from 11 fields; Sleepy Creek (Navarro) was a new discovery. The Big Foot field alone supplied 2.3 million barrels of this production.

Gaines.—Gaines County produced 19 million barrels of crude oil, 18 billion cubic feet of natural gas, and 5.7 million gallons of natural-gas liquids valued at $56.6 million. Natural-gas liquids were recovered from the Seminole gasoline plant of Phillips Petroleum Co. and the new West Seminole plant of Cities Service Oil Co. The West Seminole plant was designed to process 21 million cubic feet of gas daily. Carbon black was recovered at the Seminole No. 66 plant of Columbian Carbon Co. Five oilfields were discovered during the year.

Galveston.—Tin Processing Corp., a subsidiary of the N. V. Billiton Maatschappij, continued management of the Government-owned Longhorn tin smelter at Texas City. The smelter produced over 27,000 long tons of tin during the year, all the metal going to Government stockpile. Three oil refineries at Texas City were operating during the year, and another shut down. Pan American Refining Corp. added a 21,000-barrel ultraforming unit to its refinery during the year. Republic Oil Refining Co. started its 5,500-barrel-per-day platforming unit early in the year. The platformate was to be used as a blending component to increase the octane rating of the plant's gasoline. The 18,000-barrel-per-day refinery of the Sid Richardson Refining Co. was shut down indefinitely because of poor marketing conditions. Texas City Refining Co. operated its plant at a reduced rate. A unit to recover uranium from Florida phosphate rock was put into operation at the new phosphate plant of Texas City Chemicals, Inc. Feed and fertilizer grades of dicalcium phosphate were prepared at the plant. There were 9.6 million barrels of crude oil and 9.6 billion cubic feet of natural gas produced in the county in 1954, with a combined value of $28 million. Crude oil was produced from 24 fields, 3 of which produced over 1 million barrels each—High Island, Gillock Smith, and Gillock (Big Gas sand).

Garza.—Thirteen oilfields were active in Garza County in 1954, including 4 discovery fields that produced 4.2 million barrels of crude oil; 1 field—the Garza—alone produced 2.8 million barrels. In addition, 33.6 million cubic feet of natural gas was also produced. C. I. Green Sand & Gravel Co. produced building sand.

Gillespie.—Building and paving sand and gravel were produced at the fixed plant of Alvin Usener and by a portable plant of Weirich Bros., both near Fredricksburg. The Texas Highway Department mined and crushed limestone for paving and road-base purposes. Dezendorf Marble Co. ground and prepared feldspar for roofing purposes. Southwestern Talc Corp. mined soapstone at its open pit near Willow City. The prepared material was used for insecticides, paint filler, pipe-coating enamel, and roofing material.

Glasscock.—Crude oil and natural gas valued at over $18 million were reported from Glasscock County in 1954. The crude was produced from 6 oilfields furnishing 5.6 million barrels. The crude oil was produced from the Howard-Glasscock field, Glasscock and Howard Counties, and the Spraberry Trend Area field, Glasscock and Midland Counties.

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Goliad.—Goliad County reported crude-oil production of 2.4 million barrels from 36 oilfields, including 3 discovery fields; 55.6 billion cubic feet of natural gas was also produced during the year.

Gonzales.—Crude-oil output of 35,000 barrels from 3 oilfields (including 2 discovery fields) was reported in 1954. Building and paving sand and gravel were reported from the fixed plant of Gonzales Gravel & Sand Co. near Gonzales. A miscellaneous clay used for building brick and heavy clay products was mined by Sunset Brick & Tile Co.

Gray.—Paving gravel was produced for road purposes by Division 4 of the Texas Highway Department. Natural-gas liquids were recovered from seven gasoline plants as follows: The Pampa plant of Cities Service Oil Co., the 78–1 plant of Coltexo Corp., the No. 6 plant of Kerr-McGee Oil Industries, Inc., and the Gray, Lefors, North, and Pampa plants of Phillips Petroleum Co. Carbon black was recovered from two plants—the Lefors No. 77 channel plant of Coltexo Corp. and the Coltexo roller plant of Peerless Carbon Black Co. There were 12.4 million barrels of crude oil from 2 oilfields, 1 of which was a discovery field. During 1954, 108 billion cubic feet of natural gas was produced in the county. Most of the crude oil came from the Gray County field.

Grayson.—Wray Wible produced building sand and gravel during 1954. Eighty-one oilfields, including 35 discovery fields, produced 7.5 million barrels of crude oil in the county during the year. Also produced was 6.2 billion cubic feet of natural gas. The Sadler (Penn) Oilfield alone produced 1.8 million barrels of crude oil.

Gregg.—Gregg County ranked third in mineral value in Texas in 1954, with a total of $156.3 million. The county produced 49.1 million barrels of crude oil from the East Texas oilfield and 49.2 billion cubic feet of natural gas during the year. There was one discovery field, the Willow Springs (Pettit Lower). Natural-gas liquids were recovered at six gasoline plants: The East Texas plant of Arkansas Fuel Oil Corp., the Sphear plant of Gulf Oil Corp., the Sabine plant of Magnolia Petroleum Co., the No. 18 plant of Sinclair Oil & Gas Co., and plants 31 and 47 of Warren Petroleum Corp. Three oil refineries serviced the productive East Texas oilfield in the county—those of the Dallawax Co. at Gladewater, Premier Oil & Refining Co., and Skelly Oil Co. Texas Eastman Co. began production at its new petrochemical plant at Longview. The plant produced 20 million pounds of polyethylene plastic from propane obtained from Humble Oil & Refining Co.

Grimes.—Production of 21,000 barrels of crude oil from 3 oilfields and 4.67 million cubic feet of natural gas was reported from Grimes County in 1954.

Guadalupe.—Crude oil and natural gas valued at more than $11 million were reported from Guadalupe County in 1954. There were 3.8 million barrels of crude oil reported from 11 oilfields, including 1 discovery field, the Kingsbury (Buda Lime). The Darst Creek oilfield produced 3.4 million barrels.

Hale.—Crude-oil output amounting to 2.3 million barrels was reported from 2 oilfields in 1954. The principal oilfield was the Anton-Irish, in both Hale and Lynn Counties. There was 181 million cubic feet of natural gas also produced.

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Hall.—A small quantity of gravel used for paving and road surfaces was reported in Hall County during 1954.

Hamilton.—A small quantity of building sand was produced in Hamilton County during 1954. Crushed limestone for paving and road surfacing was reported by Division 9 of the Texas Highway Department. During the year, 1.2 billion cubic feet of natural gas and a small quantity of crude oil (600 barrels) were produced.

Hansford.—Natural-gas liquids were recovered from two gasoline plants—the Hansford and the Sherman plants of Phillips Petroleum Co. Crude oil was produced from 4 oilfields, including 3 discovery fields.

Hardeman.—Gravel and crushed limestone for paving and road surfacing were reported by Division 25 of the Texas Highway Department. Certain-teed Products Corp. mined gypsum from an open pit and processed it into plaster and wall-board at Acme. Crude-oil production of 2,000 barrels was reported from the Quanah field. Natural-gas liquids were also reported produced during the year.

Hardin.—Construction was begun on a new 20-million-cubic-foot-per-day gasoline plant by American Republic Corp. This company also operates the Silsbee cycling plant, recovering natural-gas liquids from the Silsbee gasfield. Specialty sands for molding purposes were produced in the county during 1954. Crude oil amounting to 9.3 million barrels, from 46 fields, including 11 discovery fields, was produced in the county. Two oilfields each reported production greater than 1 million barrels—Village Mills, East, and Sour Lake. In addition, 25.8 million cubic feet of natural gas was also produced.

Harris.—Harris County ranked sixth in mineral value with a total of $107.3 million in the State in 1954. Minerals and mineral fuels produced included: Crude oil, natural gas, natural-gas liquids, cement, clay, sand and gravel, lime, salt, and recovered elemental sulfur. The State's second largest oil-refinery capacity was concentrated in the Houston-Baytown area, with six plants operating. A new 3,000-barrel alkylation unit was put on stream by Eastern States Petroleum Co., Inc., at its 50,000-barrel refinery at Houston. The refinery was one of the largest independent plants on the Gulf Coast. A new deasphalting unit, capable of producing 12,000 barrels of asphalt per day, was put on stream at the Baytown refinery of Humble Oil & Refining Co. Shell Chemical Corp. began operating the world's largest epon-resin plant in conjunction with its refinery.

Phillips Chemical Co. began production at its 450-ton-per-day anhydrous ammonia plants and its 45-ton-per-day triple-superphosphate fertilizer plant. Both plants are at the Adams Terminal on the Houston Ship Channel. The new plants will consume 26 million cubic feet of natural gas annually from the nearby Chocolate Bayou gasfield. Natural-gas liquids were recovered from four gasoline plants—the Clear Lake and Tomball plants of Humble Oil & Refining Co., the Satsuma plant of Russell Engineering Corp., and the Fairbanks plant of Warren Petroleum Corp. Elemental sulfur was recovered from sour gas by Consolidated Chemical Industries at Baytown.

Rock salt was mined by United Salt Corp. at its mine near Hockley. Salt in brine was recovered from wells by Diamond Alkali Co. and Texas Brine Corp. Lime was manufactured by Champion Paper & Fibre Co., Nyotex Chemicals, Inc., and Sheffield Steel Co. Most of

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this lime was used for chemical and industrial purposes; a small quantity was used for building lime. Sand and gravel was recovered at the portable plants of Albers Sand Co. and Taylor Sand & Gravel Co. near Pasadena. Sand and gravel was dredged by Horton & Horton, by Johnson, and by Parker Bros. & Co. All the dredges were near Highlands. The principal use for this sand and gravel was for building and paving; specialty, molding, and engine sands consuming lesser quantities.

Sheffield Steel Co. operated a blast furnace in Harris County, using brown iron ores mined from company pits in Cass and Cherokee Counties and ores imported from foreign countries. Clays were mined by open-pit methods by Cedar Bayou Brick & Tile Co., Houston Brick & Tile Co., Inc., Acme Brick Co., and J. M. Cordell & Sons. Principal uses for this clay were for building brick and heavy clay products; significant quantity was used for cement. The county had 3 cement plants with a combined annual capacity of nearly 6 million barrels of cement. Expansion programs were carried on at two of these plants; the plant capacity of Trinity Portland Cement Division of General Portland Cement Co. was expanded by 125 thousand barrels; cement storage capacity was added to the Houston plant of Gulf Portland Division of Ideal Cement Co. Carbon black was recovered at the Fortune No. 61 furnace plant of Columbian Carbon Co.

Harris County furnished 23.8 million barrels of crude oil and 48.1 billion cubic feet of natural gas. Fourteen new oilfields were discovered during 1954; 6 oilfields each produced over 1 million barrels of crude—the Fairbanks, Goose Creek, Houston South, Pierce Junction, Tomball, and Webster. Crude perlite and vemiculite from Western States were expanded for lightweight aggregate and for insulating purposes, the former by Perlite of Houston, Inc., and by the Trilite Corp., the latter by Vermiculite Products, Inc. Milwhite Co. ground and prepared barite for use in heavy drilling muds at its Houston plant.

Harrison.—Crude oil, natural gas, natural-gas liquids, clay, and lignite were produced in Harrison County in 1954. The McAlester Fuel Co. continued open-pit production of lignite. Clay was mined from open pits by Acme Brick Co., Marshall Brick Co., and Marshall Pottery Co. Most of the miscellaneous clay was used for building brick and heavy clay products, a smaller quantity being used for art pottery and flowerpots. Natural-gas liquids were recovered at the following gasoline plants: The Waskom plants of Arkansas Louisiana Gas Co., Waskom Natural Gas Corp., the Whelan plant of H. L. Hunt, the Whelan plants of D. E. & R. J. Whelan, and the new 45-million-cubic-feet-per-day Woodlawn plant of Woodlawn Processing Corp. The 27 producing oilfields in the county included 7 discovery fields and produced 1.3 million barrels of crude oil. Natural-gas production amounted to 72.3 billion cubic feet.

Hartley.—Crude oil and natural gas were produced in Hartley County in 1954. Two oilfields—1 of which, the Rehm (Granite Wash), was a new discovery in 1954—yielded 3,000 barrels of crude.

Haskell.—Production of crude oil, natural gas, and sand and gravel with a total value of $9.4 million was reported from Haskell County in 1954. A small quantity of sand and gravel for road purposes was reported. Crude-oil production amounted to 3.2 million barrels from

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50 oilfields, 4 of which were discovery fields. There were 137 million cubic feet of natural gas produced during the year.

Hays.—Sand and gravel was produced at a portable plant of Hays County Gravel Co. for building and paving purposes. Natural-gas liquids were reported from the county in 1954.

Henderson.—Clays, crude oil, natural gas, and natural-gas liquids valued at nearly $6 million were reported produced in Henderson County in 1954. Athens Tile & Pottery Co. sold stoneware clay. Ath-Tex Ceramics Co. and Texas Clay Products Co. produced miscellaneous and stoneware clays for tile and heavy clay products; fire clay for use in refractory shapes was also produced. Natural-gas liquids were recovered at the Trinidad gasoline plant of Lone Star Gas Co. and the Opelika plant of Lone Star Producing Co. Five oilfields yielded 927,000 barrels of crude oil. During the year, 3.4 billion cubic feet of natural gas was produced.

Hidalgo.—Miscellaneous stone was produced by Heldenfels Bros. Anderson Brick Co. produced a small quantity of miscellaneous clay. Sand and gravel used for building and paving purposes and as railroad ballast was produced by Crow Gravel Co., Fordyce Gravel Co., and J. C. Martin. Oil refineries in Hidalgo County were McBride Refining Co., Inc., refinery, La Blanca, and Rado Refining Co. refinery, McAllen. Natural-gas liquids were recovered at the Taylor-Mayfair cycling plant of Taylor Oil & Gas Co. and Mayfair cycling plant of Taylor Oil & Gas Co. and Mayfair Minerals, Inc. Crude oil totaling 682,000 barrels was produced from 25 oilfields, which included 4 discovery fields. Natural gas amounting to 54.6 billion cubic feet was also produced.

Hill.—Division 9 of the Texas Highway Department produced paving sand for road-maintenance purposes. A small quantity of crude oil was also produced in the county in 1954.

Hockley.—Natural-gas liquids were recovered at the Ropes gasoline plant of Honolulu Oil Corp. and the Levelland and Slaughter plants of Stanolind Oil & Gas Co. The Stanolind plant likewise recovered elemental sulfur. Crude-oil production of 14.7 million barrels was reported from the Slaughter field, which extends into Terry and Cochran Counties, and the Levelland field which extends into Cochran County. Natural gas amounting to 30.5 billion cubic feet was produced. Four new oilfields were discovered during the year.

Hood.—The Texas Highway Department produced paving gravel for its road-maintenance program during the year.

Hopkins.—The Pickton gasoline plant of Humble Oil & Refining Co. recovered natural-gas liquids from natural gas of the Pickton field. Crude-oil output of 2.3 million barrels was reported from 6 oilfields, including 2 discovery fields. The Pickton oilfield produced 1.5 million barrels of oil. There were 12.2 billion cubic feet of natural gas produced in the county. A. P. Green Fire Brick Co. acquired the facilities of Thermo Fire Brick Co. at Sulphur Springs.

Houston.—The Geier-Jackson cycle plant of Geier-Jackson, Inc., recovered natural-gas liquids from the Grapeland gasfield. In all, 709,000 barrels of crude oil (from 3 oilfields) and 9.5 billion cubic feet of natural gas were produced during the year.

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Howard.—Building and paving sand and gravel were produced by Clyde McMahon Sand & Gravel Co. and West Texas Sand & Gravel Co. Cosden Petroleum Corp. operated its oil refinery at Big Spring. Natural-gas liquids were recovered at the East Vealmoor gasoline plant of Reef Fields Gasoline Corp. Crude-oil production amounted to 12.5 million barrels, 5 of the contributing oilfields producing over 1 million barrels each. They were: Vealmoor East, Howard and Borden Counties; Vealmoor, Oceanic (Penn), Iatan, and East Howard, Howard and Mitchell Counties; and Howard Glasscock, Howard and Glasscock Counties. Five discovery oilfields were reported during the year. Natural-gas production amounted to 4.8 billion cubic feet. The new petrochemical plant of Phillips Chemical Co., at Big Spring produced 98-percent-minimum-purity paraxylene used as a synthetic fiber. Feed stock for the plant came from nearby Cosden Petroleum Co. refinery.

Hudspeth.—Gypsum used in special cements was produced by Southwestern Portland Cement Co. Casner Gypsum Co., Inc., also reported production of gypsum during 1954. Southwestern Talc Corp. mined talc from its open pit near Sierra Blanca and ground the crude material for use in ceramics, insecticides, paints, and rubber. Miscellaneous stone was produced by Division 24 of the Texas Highway Department and by Gifford Hill & Co., Inc.

Hunt.—Two oilfields in Hunt County produced 32.5 billion cubic feet of natural gas and 32,000 barrels of crude oil in 1954.

Hutchinson.—Hutchinson County ranked seventh in value of minerals produced in Texas in 1954. Division 4 of the Texas Highway Department produced paving gravel for road purposes during the year. Carbon black was recovered at the Borger channel plant and the Borger furnace plant of J. M. Huber Corp. and the Stinnett channel plant of United Carbon Co., Inc. Natural-gas liquids were recovered at the Sanford gasoline plant of Frank C. Henderson, the Huber plant of J. M. Huber Corp., the Fritch–151 plant of Natural Gas Pipeline Co. of America, and the Canadian, Pantex, Rock Creek, and Sanford plants of Phillips Petroleum Co. Phillips Petroleum Co. operated a refinery at Phillips. In all, 81 billion cubic feet of natural gas and 12.2 million barrels of crude oil were produced. All the crude oil came from the Hutchinson County field.

Irion.—Crude oil amounting to 58,000 barrels was reported from 5 oilfields in Irion County in 1954. No new oilfield discoveries were reported. Production of natural gas totaled 6.6 million cubic feet.

Jack.—Division 2 of the Texas Highway Department produced crushed limestone and sand and gravel for aggregate in concrete and for road surfacing. Black Hawk Gasoline Corp. recovered natural-gas liquids at its Black Hawk gasoline plant. The natural gas came from the Alco-Caddo field. Natural gas (17.7 billion cubic feet) and crude oil (6.7 million barrels) were produced during the year. More than 120 producing oilfields included 24 discovery fields in the county.

Jackson.—Natural-gas liquids were recovered at the Vanderbilt gasoline plant of Magnolia Petroleum Co. and the Francitas No. 1 cycling plant of Francitas Gas Co. Sand and gravel for paving purposes was produced by Division 13 of the Texas Highway Department. There were 51 oil-producing fields, including 11 discoveries, that yielded 11.5 million barrels of oil. Natural gas amounting to

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44.9 billion cubic feet was produced. Four of the oilfields—Francitas, North, Lolita, and West Ranch (41–A-zone and 98–A-zone)—each produced over 1 million barrels during the year.

Jasper.—Miscellaneous clay used for manufacturing building brick and heavy clay products was mined from open pits and processed by Beaumont Brick Co., Inc., and Pal-Port Clay Products Corp. Bennett-Clark Co., Inc., mined bentonite from pits in Jasper County. Eight oilfields (including 5 discovery fields) yielded 293,000 barrels of crude oil during 1954. Natural gas amounting to 8.25 million cubic feet also was produced.

Jeff Davis.—Division 24 of the Texas Highway Department produced paving gravel and crushed limestone for use in their road-maintenance program. A. L. Neyland shipped low-grade manganiferous material to the Deming, N. Mex., Government Purchase Depot.

Jefferson.—Some of the largest oil-refining capacities of Texas and the Nation were in Jefferson County. They were: The Port Arthur refineries of Atlantic Refining Co., Gulf Oil Corp. & Sinclair Refining Co.; the Beaumont refinery of Magnolia Petroleum Co.; the Nederland refinery of Pure Oil Co.; and the Port Neches refinery of The Texas Co. The Texas Co. began production at the world's largest platformer at its Port Arthur refinery, part of the company expansion program that will continue into 1955. This platformer had a rated capacity of 20,000 barrels per stream-day. Texas Gulf Sulphur Co. mined sulfur by the Frasch process at its Spindle Top dome, Jefferson County. C. A. McKinley & Sons, Inc., operated a dredge near Beaumont, producing sand and gravel for building purposes. Oystershell was dredged from the Texas side of Sabine Lake by Wm. T. Burton and by Stevens & Co. Texas Gas Corp. operated a gasoline plant in Jefferson County during the year. Crude-oil output amounting to 8.5 million barrels was produced in 33 oilfields, including 6 discovery fields; 54 billion cubic feet of natural gas was also produced. The Stowell oilfield produced over 1 million barrels of oil during the year.

Jim Hogg.—Mineral fuels valued at nearly $5 million were reported from Jim Hogg County in 1954. This included 1.3 million barrels of crude oil, 3 billion cubic feet of natural gas, and 5.7 billion gallons of natural-gas liquids. Three oilfields were discovered during the year.

Jim Wells.—Natural-gas liquids were recovered at the LaGloria cycling plant of LaGloria Oil & Gas Co. and the Seeligson plant of Magnolia Petroleum Corp. Natural gas amounting to 100 billion cubic feet and 15.3 million barrels of crude oil were produced. Fifteen oilfields were discovered during the year.

Johnson.—Sand and gravel for building and paving purposes was produced by Lain Gravel Co., Inc., and the Texas Highway Department. Texas Lime Co. produced lime for building, chemical, and industrial purposes. Crushed limestone used in manufacturing lime was produced from the company quarry 15 miles west of Cleburne.

Jones.—Dimension limestone for building purposes was quarried and dressed by Lueders Limestone Co. and West Texas Stone Co.

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A significant quantity of this dimension stone was rough architectural stone. Building and paving sand and gravel were prepared at the fixed plant of R. E. Jones Gravel Co., Inc., near Abilene. Texas Natural Gasoline Corp. operated its Wimberly No. 1 gasoline plant, stripping the gas from the Wimberly field. Petroleum Products Co. operated its oil refinery at Lueders. The county has 118 producing oilfields, 14 of which were discovery fields, yielding 7.8 million barrels of crude; 4.5 billion cubic feet of natural gas was produced.

Karnes.—Natural-gas liquids were recovered at the Karnes City gasoline plant of United Gas Pipeline Co. The Coy City gasfield served the Karnes City plant. Crude-oil output amounted to 2.1 million barrels from 14 oilfields, including 3 discovery fields; 5.4 billion cubic feet of natural gas was produced.

Kaufman.—Crushed limestone for use as an aggregate in concrete paving and road-base material was produced by Division 18 of the Texas Highway Department. Crude-oil production amounted to 1.3 million barrels from 18 oilfields. There was one discovery field—the Ham Gossett (Paluxy Lower). Natural-gas production amounted to 64 million cubic feet.

Kendall.—The Texas Highway Department produced gravel for use in paving. No other mineral was reported from Kendall County.

Kenedy.—Crude-oil production amounted to 156,000 barrels from 5 oilfields, including 2 discovery fields. Natural-gas production amounted to 2.6 billion cubic feet.

Kent.—Mineral-fuel production amounting to 6.5 million barrels of crude oil and 2.2 billion cubic feet of natural gas was reported from Kent County in 1954. The crude oil originated in 18 oilfields, including 5 discovery fields. One oilfield—the Salt Creek—produced 3.4 million barrels of crude.

Kerr.—Building gravel was produced by A. Schwartz & Son from pits near Kerrville. Crude-oil output of 3,000 barrels was reported from 3 oilfields, including 1 discovery field.

Kimble.—Three oilfields, including 1 discovery field, produced 3,000 barrels of crude during 1954.

King.—Crude-oil and natural-gas production valued at $3.4 million was reported from King County in 1954. The crude, originating from 6 oilfields, amounted to 1.2 million barrels. Natural-gas production amounted to 207 million cubic feet.

Kleberg.—Miscellaneous stone was quarried and crushed by Heldenfels Bros. Crude-oil production of 2.8 million barrels from 60 oilfields, including 10 discovery fields, and 2.2 billion cubic feet of natural gas were reported in Kleberg County in 1954.

Knox.—Crushed limestone for concrete and road metal and flexible road-base material was produced by Division 25 of the Texas Highway Department. Production of 1 million barrels of crude oil from 11 oilfields and 165 million cubic feet of natural gas was reported in Knox County in 1954.

Lamar.—Sand and gravel for building and paving purposes was produced by Skeen Sand & Gravel Co. from pits 13 miles northwest of Paris.

Lamb.—Two oilfields produced 74,000 barrels of crude oil in Lamb County during the year. Natural-gas production amounted to 2 million cubic feet.

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La Salle.—Production of 68,000 barrels of crude oil from 4 fields, including 2 discovery fields, and 267 million cubic feet of natural gas was reported in La Salle County during the year.

Lavaca.—Division 13 of the Texas Highway Department prepared gravel for paving purposes. Seven producing oilfields, including 1 discovery field, yielded 235,000 barrels of crude during the year. Natural-gas production amounted to .37 billion cubic feet. Two gasoline plants operated in the county—the Wilcox plant of Goliad Corp. and the Provident City plant of Shell Oil Co.

Lee.—Peat was mined by open-pit methods in Lee County. Two oilfields—the Tanglewood and the McDade (Wilcox 2875 feet)—produced 2,000 barrels of crude during the year.

Leon.—The Norman Gee Flynn and the Buffalo fields produced 189,000 barrels of crude during the year. Natural-gas production amounted to 14.4 billion cubic feet.

Liberty.—Texas Gulf Sulphur Co. mined elemental sulfur by the Frasch process from the Moss Bluff dome in Liberty County. Texas Construction Materials Co. produced paving sand and gravel as well as blast, engine, and filter sands at its portable plant near Cleveland. West Gasoline Co. recovered natural-gas liquids at its Hull gasoline plant. Other mineral fuels produced in the county included 13 million barrels of crude oil from 35 oilfields, including 7 discovery fields, and 17.9 billion cubic feet of natural gas. The Hull and Liberty, South, fields produced over 2 million barrels of crude during 1954.

Limestone.—Sand and gravel and crushed limestone were prepared by Division 9 of the Texas Highway Department. Three oilfields, including 1 discovery field, yielded 308,000 barrels of crude. Natural-gas production amounted to 5.9 billion cubic feet.

Live Oak.—Commercial Materials, Inc., produced sand and gravel for paving purposes. Three Rivers Refining Co. operated its refinery at Three Rivers. Goliad Corp. operated its Kittie gasoline plant during 1954. Crude oil totaling 1.1 million barrels and natural gas amounting to 52.5 billion cubic feet were produced in the county during 1954. Twenty-seven oilfields, including 5 discovery fields, produced.

Llano.—Graphilter Corp. prepared a graphitic schist as a filter material from pits about 1 mile south of Llano. Shipments of crude feldspar were made from stockpile by Mrs. Tillie Badu Moss.

Loving.—Division 6 of the Texas Highway Department mined and crushed limestone for paving purposes. Production of crude oil amounting to 1.6 million barrels and of 1.9 billion cubic feet of natural gas was reported from the county in 1954. The crude oil came from four producing oilfields.

Lubbock.—Caprock Sand & Gravel Co. produced sand and gravel for building and paving purposes. Production of 406 thousand barrels of crude oil and 2.7 million cubic feet of natural gas was reported in 1954. There were two producing oilfields in the county.

Lynn.—Production of 113 thousand barrels of crude oil and 1 million cubic feet of natural gas was reported from Lynn County in 1954. Three oilfields in the county produced during the year.

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Madison.—Production of crude oil and natural gas valued at $753,000 was reported from Madison County in 1954. The county had three producing oilfields during the year.

Marion.—Natural-gas liquids were recovered at the Jefferson and the Smithland gasoline plants of Arkansas Louisiana Gas Co. Ten producing oilfields, including 1 discovery field, yielded 952,000 barrels of crude. Natural-gas production amounted to 11.2 billion cubic feet.

Martin.—Production of 589,000 barrels of crude oil from 8 producing oilfields, including 2 discovery fields, and 86.2 million cubic feet of natural gas, with a total value of $2.2 million, was reported from Martin County in 1954.

Mason.—Crushed limestone used for paving was produced by the Texas Highway Department in 1954.

Matagorda.—Oystershell was dredged from Matagorda Bay by Matagorda Shell Co. Matagorda Corp. operated a refinery at Bay City. Natural-gas liquids were recovered at the Blessing cycling plant of American Liberty Oil Co. Production of 5.1 million barrels of crude oil from 22 oilfields, including 3 discovery fields, and 92.7 billion cubic feet of natural gas was reported in Matagorda County in 1954. One oilfield, the Sugar Valley, produced over 1 million barrels of crude.

Maverick.—Production of 210 million cubic feet of natural gas valued at $10,000 was reported from Maverick County in 1954.

McCulloch.—Crude oil amounting to 2,000 barrels was produced in McCulloch County from 2 oilfields, including 1 discovery field.

McLennan.—Crushed limestone used for paving purposes and in manufacturing portland cement was reported by Division 9 of the Texas Highway Department and Universal Atlas Cement Co., respectively. Sand and gravel for building and paving purposes was produced by Central Texas Gravel Co., Neeley Sand & Gravel Co., and Kleberg Sand & Gravel Co. Universal Atlas Cement Co. manufactured portland cement at its Waco plant in McLennan County. This company also mined clay for manufacturing cement. South Bosque oilfield produced 6,000 barrels of crude during the year.

McMullen.—Production of 730,000 barrels of crude oil from 17 oilfields, including 1 discovery field, and 11.4 billion cubic feet of natural gas valued at $3.2 million was reported from McMullen County in 1954.

Medina.—D'Hanis Brick & Tile Co. mined miscellaneous clay for manufacturing building brick and heavy clay products. Two oilfields produced 19,000 barrels of crude during the year.

Menard.—A small quantity of crude oil was reported from Menard County in 1954.

Midland.—Natural-gas liquids were recovered at the Sweetie Peck gasoline plant of El Paso Natural Gas Co., the Pecos plant of Pecos Co., and the Spraberry plant of Phillips Petroleum Co. Twenty-eight oilfields, including 6 discovery fields, yielded 13.1 million barrels of crude during the year. Two of these oilfields (Midland Farms and Spraberry Trend Area, the latter extending into Glasscock County) each produced over 4 million barrels of crude. Natural-gas production amounted to 62.9 billion cubic feet. Crushed limestone and crushed miscellaneous stone used for paving were produced by

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Division 6 of the Texas Highway Department. Perlite mined in other States was expanded by Perlite Industries, Inc.

Milam.—Texas ranked second among the aluminum-producing States in the Nation, when Aluminum Co. of America reached capacity at its Rockdale reduction works. A unique feature was the use of lignite as fuel for firing the electric power plant's steam-driven turbo-generators. The lignite was mined by open-pit methods from deposits near the power plant. Sand and gravel for building and paving purposes was prepared by the Herman R. Sedlitz Estate and by Mrs. W. A. Robinson. The Minerva Rockdale oilfield produced 49,000 barrels of crude oil. Natural-gas production amounted to 75 million cubic feet.

Mitchell.—In 1954 the 14 oilfields, including 3 discovery fields, produced 1.2 million barrels of crude oil; and production of 54 million cubic feet of natural gas was also reported from Mitchell County. The Sharon Ridge field (Mitchell and Scurry Counties) and the Iatan field (Mitchell and Howard Counties) each produced over 1 million barrels of crude oil during the year. Sun Oil Co. operated its North Jameson gasoline plant, stripping natural-gas liquids from the gas of North Jameson field. Col-Tex Refining Co. completed a new 1,500-barrel-per-day platformer at its Colorado City refinery. The new facilities produced a platformate with a leaded octane ranging from 93 to 96 for use as a blending component for motor fuel. Building and paving sand and gravel were prepared by Colorado Sand & Gravel Co.

Montague.—Crude oil, natural gas, natural-gas liquids, and sand and gravel valued at $26.6 million were produced in Montague County in 1954. O. W. Watson Sand & Gravel Co. prepared building sand at its pits 2½ miles north of Bowie. Natural-gas liquids were recovered at the Bowie gasoline plant of Bowie Gasoline Co. A recovery of 8.7 million barrels of crude oil from 145 oilfields (including 27 discovery fields) was reported, and 11.8 billion cubic feet of natural gas was produced. The Montague County oilfield produced over 1 million barrels of crude.

Montgomery.—Columbian Carbon Co. recovered carbon black at its Conroe No. 63 furnace plant. Natural-gas liquids were recovered at Humble Oil & Refining Co., and Midland Gasoline Co., Conroe, gasoline plants and Superior Oil Co., Lake Creek, cycling plant. Production of 11 million barrels of crude oil from 16 oilfields (including 5 discovery fields) and 26.6 billion cubic feet of natural gas was reported during 1954. The Conroe oilfield produced 10 million barrels of crude.

Moore.—Production of crude oil, natural gas, natural-gas liquids, helium, and recovered sulfur amounted to $37 million in 1954. The Amarillo helium plant, 1 of 4 Government-operated plants in Texas, Kansas, and New Mexico, operated throughout 1954. Combined production at all four plants exceeded the demand, so that the surplus was returned to the Cliffside helium-bearing gasfield to increase the helium reserves. At the end of 1954 this reserve amounted to 87 million cubic feet of helium. Carbon black was recovered at the Continental furnace plant of Continental Carbon Co. The Sunray refinery of Shamrock Oil & Gas Corp. operated throughout 1954. Natural-gas liquids were recovered at the Bivins and Four-Way gasoline plants of Colorado Inter-State Gas Co., at the Cactus-12

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plant of Kerr-McGee Oil Industries, Inc., at Station-152 plant of Natural Gas Pipeline Co. of America, at the Dumas and Sneed plants of Phillips Petroleum Co., and the McKee-Sunray plant of Shamrock Oil & Gas Corp. Elemental sulfur was recovered at the McKee-Sunray plant of Shamrock Oil & Gas Corp. by the Mathieson process. Production of 101,000 barrels of crude oil from the Moore County field and 37.1 billion cubic feet of natural gas was reported during the year. Zinc metal was recovered at the Machevoc retort smelter of American Zinc Co. of Illinois near Dumas, Morris County. Brown iron ore was mined by open-pit methods for consumption in the blast furnace of Lone Star Steel Co.

Motley.—Paving sand and gravel was produced by Harris Sand Co.

Nacogdoches.—Acme Brick Co. mined miscellaneous clay for manufacturing building brick and heavy clay products. Production of 20,000 barrels of crude oil from the Trawich (Rodessa) oilfield and 10.8 billion cubic feet of natural gas in the county during 1954 was reported.

Navarro.—Miscellaneous clay used for building brick and heavy clay products was mined from pits 1 mile south of Corsicana by the Whiteside Brick & Lumber Co. Production of 2.2 million barrels of crude oil from 10 oilfields (including 1 discovery field) and 151 million cubic feet of natural gas was reported during 1954. The Corsicana Shallow field produced more than 1 million barrels of crude during the year.

Newton.—Production of 865,000 barrels of crude oil from 13 oilfields (including 2 discovery fields) and 6 billion cubic feet of natural gas was reported from Newton County in 1954.

Nolan.—There were 2 natural-gasoline plants, 1 oil refinery, and 1 cement plant in Nolan County. Minerals produced included: Crude oil, natural gas, cement, sand and gravel, gypsum, limestone used for cement, and clay used for cement. Gypsum was mined by United States Gypsum Co. from pits near Sweetwater, for manufacturing wallboard and building and special plasters. Building and paving sand and gravel were prepared by Hillsdale Gravel Co. at pits 4 miles southwest of Sweetwater. Champion Sand & Gravel Co. produced building and paving sand and gravel during the year. Cement was produced at the Mary Neal plant of Lone Star Cement Corp. This company mined its own limestone and clay used for manufacturing cement. Natural-gas liquids were recovered at the Rowan & Hope gasoline plants of Rowan & Hope and at the South Lake Trammel plant of Sun Oil Co. Gulf Oil Corp. closed its Sweetwater oil refinery in November 1954, because it was not equipped to manufacture the high-octane gasolines required in todays' automotive markets. Crude-oil production of 4.2 million barrels from 49 oilfields (including 21 discovery fields), and 2.3 billion cubic feet of natural gas was reported from the county during the year.

Nueces.—Columbia Southern Chemical Corp. manufactured hydrated lime from oystershell for use in its chemical plant. Oystershell for manufacturing cement, lime, and building and paving purposes was dredged from Nueces Bay by Corpus Christi Shell Co. and General Dredging Co. Sand and gravel used for building and paving purposes was mined from pits of Heldenfels Bros. near Calallen. Halliburton Portland Cement Co. manufactured cement from oyster-

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shell at its Corpus Christi plant. A significant quantity of Texas oil-refining capacity was at Corpus Christi. The following companies operated refineries in the county: Pontiac Refining Co., Sinclair Refining Co., Southwestern Oil & Refining Co., Taylor Oil & Gas Co., Corpus Christi Refining Co., and the new 30,000-barrel-per-day refinery of Suntide Refining Co. Daily capacity of Corpus Christi Refining Co. plant was raised to 8,000 barrels. The output per day now consists of 4,000 barrels of jet fuel, 1,200 barrels of gasoline, 1,600 barrels of gas oil, and 1,200 barrels of fuel oil. Great Southern Chemical Corp., which produces aromatic hydrocarbons, added a 4,000-barrel integrator with a 3,490-barrel Udex unit. Natural-gas liquids were recovered at the Flour Bluff gasoline plant of Humble Oil & Refining Co., the McCoy plant of Nueces Co., the Saxet and Stratton plants of Southern Minerals Corp., the Luby plant of Stanolind Oil & Gas Co., the Dean plant of Tennessee Production Co., and the Agua Dulce plant of United Gas Pipeline Co. The electrolytic zinc smelter of the American Smelting & Refining Co. treated zinc concentrate from Western States and from foreign counties during 1954. Crude oil totaling 15.5 million barrels from 104 oilfields (including 17 discovery fields) and natural gas amounting to 217.5 billion cubic feet were produced in the county during 1954. The Agua Dulce oilfield produced over 1 million barrels of crude during 1954. Barite from other States and from foreign nations was ground and prepared as a heavy drilling mud by Baroid Sales Division of National Lead Co.

Ochiltree.—Production of crude oil from 2 oilfields, the McGarraugh (Penn) and the Buler (Penn), and of natural gas, with a combined value of $106,000, was reported in 1954.

Oldham.—Paving gravel was produced by Division 4 of the Texas Highway Department. Building and paving sand and gravel and gravel for railroad ballast were produced at the fixed plants of Western Aggregates, Inc., near Tascosa and Western Sand & Gravel Co. near Channing. Natural gas totaling 428 million cubic feet was produced during the year.

Orange.—Production of 3.8 million barrels of crude oil from 14 oilfields (including 2 discovery fields) and 56.7 billion cubic feet of natural gas was reported in Orange County in 1954. Spencer Chemical Co. began constructing a new $14 million polyethylene plant near the Sabine River south of Orange. Another petrochemical plant, Nitrogen Division of Allied Chemical & Dye Corp., built a 16,000-ton ethylene oxide unit.

Palo Pinto.—The Texas Highway Department prepared paving gravel for use in its road-maintenance program. Building and paving sand and gravel were prepared at the fixed plant of Mineral Wells Sand & Gravel Co. near Mineral Wells. Featherlite Corp. mined shale from pits near Strawn for use as a lightweight aggregate. Clays used to manufacture floor tile were mined from pits 3 miles east of Mineral Wells by Texeramics Co. Texas Vitrified Pipe Co. mined clay for heavy clay products. Production of 268,000 barrels of crude oil from 11 oilfields, including 2 discovery fields—the Fox Hollow (Strawn) and the Gaulden (Fry), and 1.4 billion cubic feet of natural gas was reported from Palo Pinto County in 1954. Natural-gas liquids were recovered at the Gordon gasoline plant of Lone Star Gas Co.

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Panola.—Mineral fuels valued at $57.5 million were reported produced in Panola County in 1954. Natural-gas liquids were recovered from five gasoline plants, Arkansas Fuel Oil Corp., Panola and Carthage; Carthage Co., Chicago Corp., and United Gas Pipeline Co. plants, and the Lone Star Producing Co. cycling plant, all of Carthage. Crude-oil production of 459,000 barrels from 5 oilfields—including 1 discovery field, the Blalock (Pettit Alower)—and production of 403.5 billion cubic feet of natural gas were reported in Panola County during the year.

Parker.—Minerals produced in Parker County included: Crude oil, natural gas, natural-gas liquids, clay, and sand and gravel. Miscellaneous clay was mined by Acme Brick Co. and Mineral Wells Clay Products Co. for manufacturing building brick and tile. Dimension sandstone for rough construction stone was prepared by Ben Roy Gholson. Division 2 of the Texas Highway Department quarried and crushed sandstone and limestone for paving and road-base material and prepared paving gravel for road maintenance. Natural-gas liquids were recovered at the Springtown gasoline plant of Lone Star Gas Co. A production of 61,000 barrels of crude oil from 4 oilfields—including 1 discovery field named Toto (Strawn Lower)—and 191 million cubic feet of natural gas was reported in the county during the year.

Pecos.—Sand and gravel for building and paving purposes was prepared at the fixed plant of F. M. Reeves & Sons, Inc., near Imperial and by Imperial Sand & Gravel Co. Natural-gas liquids were recovered at the Santa Rosa No. 3 gasoline plant of Pecos Co. An amine-circulating-type plant to remove carbon dioxide from natural gas was put in operation by Permian Basin Pipeline Co. The plant near Fort Stockton, processed 25 million cubic feet of natural gas daily, with facilities readily expandable to 150 million cubic feet. R. J. Reischman refinery at Fort Stockton operated throughout the year. Production of 16.9 million barrels of crude oil and 24.6 billion cubic feet of natural gas was reported during the year. Three oilfields—Fort Stockton, Toborg, and Yates—produced over 1 million barrels each in 1954. Two discovery fields were found during the year.

Polk.—The Texas Highway Department produced crushed sandstone for use as a road base in its highway-maintenance program and prepared washed and crushed gravel for paving. Sand for blasting and for filtering was prepared at Texas Construction Materials Co. portable plant, near Corrigan. Production of 2 million barrels of crude oil from 14 oilfields (including 1 discovery field) and 5.4 billion cubic feet of natural gas was reported during the year.

Potter.—Helium was produced at the Government-owned-and-operated Exell plant, north of Amarillo. Miscellaneous stone (caliche) was quarried and crushed for use as road-base and road-surfacing material by Division 4 of the Texas Highway Department. The division also prepared gravel for paving purposes. Building and paving sands were prepared at Panhandle Gravel Co., Inc., fixed plant, near Amarillo; and by Texas Sand & Gravel Co., Ltd. The Amarillo refinery of The Texas Co., Amarillo, operated during 1954. Natural-gas liquids were recovered at the Fain and the Turkey Creek gasoline plants of the Amarillo Oil Co. In all, 2,000 barrels of crude

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oil and 69.8 billion cubic feet of natural gas were produced in the county. One discovery oilfield was reported during the year.

Reagan.—Mineral fuels, crude oil, natural gas, and natural-gas liquids valued at $37 million were reported from Reagan County in 1954. Natural-gas liquids were recovered at the Barnhart gasoline plant of Barnhart Hydrocarbon Corp. and at the new Midkiff gasoline plant of El Paso Natural Gasoline Co. This latter plant, 40 miles north of Big Lake, was placed on stream in November 1954. Production of 11.1 million barrels of crude oil from 13 oilfields (including 3 discovery fields) and 34.6 billion cubic feet of natural gas was reported. Most of the crude oil came from the Spraberry Trend Area field of Reagan and Upton Counties.

Real.—Gravel for paving purposes was prepared by Division 22 of the Texas Highway Department.

Red River.—There were 7,000 barrels of crude oil from 3 oilfields reported from Red River County in 1954.

Reeves.—Limestone was quarried and crushed for use as a flexible road base by Division 6 of the Texas Highway Department. The division also prepared gravel for paving purposes. Sand and gravel for building and paving purposes was prepared at the fixed plant of F. M. Reeves & Sons, Inc., near Pecos, and by Herman A. Lindly. Natural-gas liquids were recovered at the Orla gasoline plant of Pecos Petroleum Co. Crude-oil production of 326,000 barrels from 6 oilfields (including 1 discovery field) and 1.4 billion cubic feet of natural gas was reported in the county during the year.

Refugio.—Production of crude oil, natural gas, and natural-gas liquids was reported from Refugio County in 1954. Natural-gas liquids were recovered at the Tom O'Connor gasoline plant of Humble Oil & Refining Co. and the Wyrick & Hughes plant of Wyrick & Hughes. Refugio County reported production of 18.2 million barrels of crude oil from 50 oilfields (including 17 discovery fields) and 121 billion cubic feet of natural gas. The Tom O'Connor and the Greta oilfields each produced over 2 million barrels of crude.

Roberts.—Production of 1.4 million barrels of crude oil from the Quinduno (Lower Albany Dolomite) field and 3.9 billion cubic feet of natural gas was reported from Roberts County in 1954.

Robertson.—Building and paving sand and gravel and some gravel for railroad ballast were prepared at the portable plant of Gifford-Hill & Co. near Hearne. A production of 23,000 barrels of crude oil from the Calvert field and of 117 million cubic feet of natural gas for the entire county during the year was reported.

Rockwall.—Sandstone was quarried and crushed by the Texas Highway Department for use as a concrete aggregate and road-base material.

Runnels.—Natural-gas liquids were recovered at the Runnels semiportable gasoline plant of the Gulf Oil Corp., 10 miles northwest of Winters, the Fort Chadbourne plant of Lone Star Producing Co., and the Sykes plant of Runnels Gas Products Corp. The recovery of 6.2 million barrels of crude oil from 108 oilfields, including 27 discovery fields, was reported, and 13.4 billion cubic feet of natural gas was produced in Runnels County during the year. Two oilfields, the Fort Chadbourne in Coke and Runnels Counties and the Cree-Sykes (Upper Gardner), each produced over 1 million barrels of crude.

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Rusk.—Miscellaneous clay for manufacturing building brick and heavy clay products was quarried by Major Brick Co. and J. M. Cordell & Sons. Natural-gas liquids were recovered at the Cashen gasoline plant of Gulf Oil Corp., the East Texas plant of Humble Oil & Refining Co., the Giles plant of Parade Co., and plants 19 and 21 of Sinclair Oil & Gas Co. The oil and gas industry produced 29.2 million barrels of crude oil and 17.7 billion cubic feet of natural gas. The 9 producing oilfields included 4 discovery fields.

San Jacinto.—The Texas Highway Department prepared gravel for paving purposes. Building sand and gravel was dredged by Thorstenberg & Tamborello near Sheppard. The county reported production of 604,000 barrels of crude oil and 5.7 billion cubic feet of natural gas during the year. There were seven producing oilfields.

San Patricio.—Reynolds Metals Co. operated its La Quinta alumina plant and its San Patricio aluminum-reduction works throughout the year. The bauxite ore treated at the La Quinta plant was imported from Jamaica. Building and paving sand and gravel and gravel for railroad ballast were mined and prepared by Fordyce Gravel Co. from pits near Mathis. Miscellaneous stone was produced by Heldenfels Bros. for road-base and paving purposes. Natural-gas liquids were recovered at plant 20 of Sinclair Oil & Gas Co. and the Plymouth & Rooke cycle plant of Plymouth Oil Co. The oil and gas industry produced 16.7 million barrels of crude oil and 71.2 billion cubic feet of natural gas. The 91 producing oilfields included 13 discovery fields; the Portilla (7,400-feet, sand), the Plymouth, and the Whitepoint East fields each produced over 1 million barrels of crude.

Schleicher.—Production of 3.2 million barrels of crude oil from 17 oilfields (including 2 discovery fields) and 1.4 billion cubic feet of natural gas was reported from Schleicher County in 1954.

Scurry.—Building and paving sand was prepared by Burleson & Highsmith and Ira Sand & Gravel Co. Natural-gas liquids were recovered at the Diamond-M gasoline plant of Lion Oil Co., the North Snyder plant of Standard Oil Co. of Texas, the Snyder plant of Sunray Oil Corp., and the Fuller plant of The Texas Co. Production of 36.1 million barrels of crude oil and 43.5 billion cubic feet of natural gas was reported during the year. The discovery of eight oilfields was reported.

Shackleford.—Building gravel was prepared by Taylor Bros. in 1954. Pumicite (volcanic ash) was mined from deposits, 5 miles from Hermleigh, by the Kelly Products Co. Natural-gas liquids were recovered at the Ibex gasoline plant of Ibex Co. and No. 1 plant of Marshall R. Young. The oil and gas industry produced 2.5 million barrels of crude oil from 55 oilfields, including 8 discovery fields, and 5.2 billion cubic feet of natural gas during the year. The Shackelford County field produced over 1 million barrels of crude.

Shelby.—Production of 10,000 barrels of crude oil from 3 oilfields and 15.8 billion cubic feet of natural gas was reported from Shelby County.

Sherman.—Mineral-fuel production valued at $10 million was reported from Sherman County in 1954. Crude-oil production amounted to 18,000 barrels from 3 oilfields including 1 discovery field—the Coldwater (K-Zone). Natural-gas production amounted to 143.9 billion cubic feet.

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Smith.—Mineral production, consisting of crude oil, natural gas, natural-gas liquids, clay, and sand and gravel, valued at $8.3 million, was reported from Smith County in 1954. Fire clay was mined by General Refractories, Co. and the J. J. Bird Co. for manufacturing refractories and stoneware. Molding sand was prepared by J. Ellis. McMurrey Refining Co. operated its refinery at Tyler, as did the Premier Oil & Refining Co., with a refinery at Arp. Natural-gas liquids were recovered at the Chapel Hill cycling plant of Lone Star Producing Co. and the Chapel Hill gasoline plant of Etexas Producers Gas Co. There were 13 producing oilfields, including 2 discovery fields, which yielded 1.3 million barrels of crude oil. Natural-gas production amounted to 8.5 billion cubic feet.

Somervell.—The Texas Highway Department prepared paving gravel for its road-maintenance program during the year.

Starr.—Mineral production valued at $24.6 million and consisting of crude oil, natural gas, natural-gas liquids, and pumicite was reported from Starr County in 1954. Pumicite was mined from a pit near Rio Grande City and processed by Pozzolana, Inc. The Rincon plant of Continental Oil Co. and the Sun plant of Sun Oil Co. recovered gasoline from natural-gas liquids. The 62 oilfields, including 6 discovery fields, yielded 7.5 million barrels of crude. Natural-gas production amounted to 30.8 billion cubic feet. The Garcia oilfield produced over 1 million barrels of crude during the year.

Stephens.—Natural-gas liquids were recovered at the Eliasville gasoline plant of Breckenridge Gasoline Co., the Brooks plant of Lone Star Producing Co., the Caddo plant of Texas Pacific Coal & Oil Co., and Plant No. 30 of Warren Petroleum Corp. The 72 producing oilfields in the county included 13 discovery fields and yielded 2.4 million barrels of crude. The Stephens County oilfield produced over 1 million barrels of crude. Natural-gas production amounted to 10.9 billion cubic feet during the year.

Sterling.—Production of 605,000 barrels of crude oil and 12 million cubic feet of natural gas was reported in Sterling County in 1954. There were 12 producing oilfields, including 3 discovery fields.

Stonewall.—The 53 oilfields in production included 10 discovery fields and yielded 8 million barrels of crude during 1954. Four oilfields produced over 1 million barrels each: Boyd (Conglomerate), Flowers (Canyon Sand), Katz, and Old Glory. Stonewall Gas Products Co., Inc., operated its Stonewall natural-gasoline plant during 1954. Production of 3 billion cubic feet of natural gas was reported during the year.

Sutton.—Production of 21,000 barrels of crude oil and 3.5 billion cubic feet of natural gas was reported in Sutton County in 1954. The 3 producing oilfields included 1 discovery field—the Blue Bonnet (Canyon Lime).

Tarrant.—Mineral production consisting of cement, clay, sand and gravel, stone, and recovered elemental sulfur valued at $7.2 million was reported from Tarrant County in 1954. Shell Chemical Corp. recovered elemental sulfur by the oxidation process at its petrochemical plant. Crushed limestone used as a flexible road base and paving gravel were prepared by the city of Fort Worth, the Tarrant County Highway Department, and the Texas Highway Department. An important commercial sand and gravel industry in the county

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consisted of 15 producers who mined and prepared this material for building and paving purposes. Some glass sand was also produced by L. A. Bryan. Sand and gravel producers in Tarrant County in 1954 were: Abbott & Newman, L. A. Bryan, Bryan & Ferguson Sand & Gravel Co., Joseph E. Campbell, J. H. Campbell, H. C. Cone, Findley Sand & Gravel Co., Fort Worth Sand & Gravel, Inc., Hartson Gravel Co., R. B. Hartson, Jr., Hurst Gravel Co., Industrial Concrete & Supply Co., Jefferies & Betts Gravel Co., Inc., Midway Sand & Gravel Co., Inc., and the B & M Gravel Co. Cement was produced by the Trinity Division of General Portland Cement Co. The company quarried and crushed the limestone required in manufacturing cement. Crude oil was refined at the Fort Worth refineries of Magnolia Petroleum Co. and Premier Oil Refining Co. of Texas.

Taylor.—Miscellaneous clay was mined by Abilene Brick Co. from pits 4 miles north of Abilene for manufacturing building brick. Sand and gravel was prepared for building and paving purposes by Atlas Sand & Gravel Co., Brazos Sand & Gravel Co., Caton Sand & Gravel Co., and Waco Sand & Gravel Co. Natural-gas liquids were recovered at the Eskota gasoline plant of Otha H. Grimes. Production of 1.6 million barrels of crude oil from 65 oilfields (including 13 discovery fields), and 129 million cubic feet of natural gas was reported from the county in 1954.

Terrell.—Crushed limestone for use as a road base was prepared by Division 6 of the Texas Highway Department.

Terry.—Carbon black was recovered at the Seagraves No. 64 furnace plant of Columbian Carbon Co. Production of 5.8 million barrels of crude oil from 16 oilfields (including 4 discovery fields) and 648 million cubic feet of natural gas was reported in the county in 1954. The Wellman and the Adair (Wolfcamp) oilfields each produced over 1 million barrels of crude. The 4 discovery oilfields were: The Adair Northeast (Wolfcamp), the Alex (5,900 feet), the Wellman Northwest (Silurian-Devonian), and the Terryon (Glorieta).

Throckmorton.—The Texas Highway Department prepared paving gravel for its road-maintenance program. There were 102 producing oilfields in the county in 1954, which included 12 discovery fields, yielding 3.2 million barrels of crude oil. Natural-gas production amounted to 448 million cubic feet.

Titus.—American Liberty Oil Co. operated its refinery at Mount Pleasant. Production of 4.1 million barrels of crude oil and 10 million cubic feet of natural gas was reported in 1954. The Pewitt Ranch and the Talco oilfield (the latter extending into Franklin County) each yielded over 1 million barrels of crude oil in 1954.

Tom Green.—The city of San Angelo produced sand and gravel for paving purposes in 1954. A production of 1.3 million barrels of crude oil from 25 oilfields (including 6 discovery fields) and 89 million cubic feet of natural gas was reported in Tom Green County in 1954. Natural-gas liquids were recovered during the year.

Travis.—Abrasive stone (grinding pebbles) was mined from pits 15 miles from Austin by Dezendorf Marble Co. Lime was manufactured by Austin White Lime Co. from limestone quarried near McNeil, principally for building, chemical, and industrial purposes. A small quantity was used for agricultural purposes. Dezendorf Marble Co. quarried and crushed "marble" a hard, crystalline limestone, from a

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pit 10 miles from Austin and prepared terrazzo or marble flour. Limestone was quarried and crushed for use as a road base by the Texas Highway Department and for riprap, metallurgical flux, railroad ballast, agricultural lime, and concrete by Texas Crushed Stone Co. and for manufacturing lime and for metallurgical flux by Austin White Lime Co. Dimension limestone used as dressed building stone and for flagging was prepared by Austin Stone, Industries, Inc. Sand and gravel was prepared for building and paving purposes at the fixed plant of R. E. Jones Gravel Co. near Austin, and paving gravel was prepared by the Texas Highway Department. It was reported that 41,000 barrels of crude oil was produced from 2 oilfields—the Elroy East and the Kimbro.

Trinity.—Fuller's earth was mined and processed as a filtering medium by Trinity Clay Products Co. There was 237 million cubic feet of natural gas produced during the year.

Tyler.—The 16 producing oilfields included 1 discovery field and yielded 722,000 barrels of crude during 1954. Natural-gas production amounted to 4.7 billion cubic feet, and natural-gas liquids were recovered at the Joe's Lake gasoline plant of American Republics Corp.

Upshur.—Sand and gravel for building and paving purposes, railroad ballast, and molding sand was prepared by Big Sandy Sand & Gravel Co. Natural gas and crude oil valued at $9.6 million were produced in the county during 1954. Crude production amounted to 3.3 million barrels and natural-gas output to 1.3 billion cubic feet. Crude oil was produced from two fields; the East Texas field of Upshur, Gregg, and Cherokee Counties was responsible for most of this crude production.

Upton.—Crushed limestone was produed by Division 6 of the Texas Highway Department for concrete, aggregate for road metal, and flexible road base. Natural-gas liquids were recovered at the McElroy-Wilshire gasoline plant of Lone Star Producing Co., the Benedum and Pembrook plants of Phillips Petroleum Co., and the Benedum plant of Texas Gas Products Corp. Crude-oil production amounted to 17.4 million barrels from 35 oilfields, including 6 discovery fields. Three of the oilfields—Wilshire (Ellenburger), McCamey, and Pegasus—extending into Midland County, each produced over 1 million barrels of crude.

Uvalde.—Native asphalt for road surfacing was quarried and processed by Uvalde Rock Asphalt Co. from pits 2 miles south of Blewett and by White's Uvalde Mines from pits 20 miles west of Uvalde. Southwest Stone Co. crushed basalt for concrete for building and paving purposes.

Val Verde.—The Texas Highway Department produced a small quantity of gravel for paving purposes.

Van Zandt.—Morton Salt Co. produced both rock and evaporated salt from its underground mine and from salt wells. Natural-gas liquids were recovered at the Van gasoline plant of The Pure Oil Co. Production of 8.8 million barrels of crude oil was reported from 4 oilfields; the Van field furnished most of this production. Natural gas totaling 3.6 billion cubic feet was produced.

Victoria.—Building and paving sand and gravel and gravel for railroad ballast were produced by Fordyce Gravel Co. and the fixed plant of Heldenfels Bros. near Victoria. The 46 producing oilfields in-

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cluded 7 discovery fields and yielded 7.1 million barrels of crude. The Placedo and the Bloomington oilfields (4,600 feet) each produced over 1 million barrels of crude. Natural-gas production amounted to 89.6 billion cubic feet. Natural-gas liquids were also recovered.

Walker.—Fuller's earth was mined from pits near Riverside in Walker County by Milwhite Co. During the year, 9,000 barrels of crude oil was produced from the Sam Houston field.

Waller.—Building and paving gravel was prepared by the Waller County Road & Bridge Department. The Katy cycling plant of Humble Oil & Refining Co. operated throughout the year. Crude-oil production of 381,000 barrels and natural-gas production of 1.4 billion cubic feet were reported during the year. Four oilfields produced, including 1 discovery field—the Brookshire (6,800 feet, sand).

Ward.—Sodium sulfate was produced by Ozark-Mahoning Co. from saline deposits near Monahans. Sand and gravel for building and paving purposes was prepared at the fixed plant of Permian Sand & Gravel Co. near Royalty. Natural-gas liquids were recovered at the Estes gasoline plant of Cabot Carbon Co., the Sealy-Smith plant of El Paso Natural Gas Co., and the Monahans plant of Gulf Oil Corp. Wickett Refining Co. operated an oil refinery near Wickett. The 25 oilfields, including 4 discovery fields, yielded 9.7 million barrels of crude during the year. The Ward South field produced over 4 million barrels of crude. Natural-gas production amounted to 25.2 billion cubic feet.

Washington.—Washington County produced 324,000 barrels of crude oil from 5 oilfields and 43 million cubic feet of natural gas during 1954.

Webb.—Sand and gravel for paving purposes was prepared by the city of Laredo and the Texas Highway Department. Crude-oil production of 2.1 million barrels from 40 oilfields, including 6 discovery fields, and output of 498 million cubic feet of natural gas were reported in Webb County in 1954. National Lead Co. operated its Laredo antimony smelter throughout the year. Most of the smelter receipts were from foreign sources.

Wharton.—Sulfur was mined by the Frasch process from the Boling dome of Texas Gulf Sulphur Co. The Texas Highway Department prepared sand for paving purposes for use in its road-maintenance program. Natural-gas liquids were recovered at the West Bernard gasoline plant of Tidewater Associated Oil Co. The 38 oil-producing fields, including 3 discovery fields in Wharton County, yielded 7.1 million barrels of crude oil. The Withers North and the Magnet Withers oilfields, each produced over 1 million barrels of oil. Production of natural gas amounted to 83.7 billion cubic feet.

Wheeler.—Carbon black was recovered at the Norrick furnace plant of United Carbon Co., Inc. Natural-gas liquids were recovered at the Shamrock gasoline plant of Columbia Gasoline Corp. and the McLean–28 plant of Warren Petroleum Corp. The Wheeler County and the Osborne Area fields produced 1.2 million barrels of crude oil during the year. Natural-gas production amounted to 16.1 billion cubic feet.

Wichita.—Crushed sandstone used for riprap and for concrete and road metal was quarried and crushed by Division 3 of the Texas Highway Department. Crushed limestone for riprap and concrete

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and road metal was quarried and prepared by the Wichita County Highway Department. Sand and gravel for building and paving purposes was prepared at the Foley Sand & Gravel Co. fixed plant near Wichita Falls and Gravel, Inc., and Northwest Materials Co. fixed plants, both near Iowa Park. Continental Oil Co. operated a refinery at Wichita Falls. The refinery of La Salle Petroleum Corp. at Burkburnett was shut down during the year. Natural-gas liquids were recovered at the K. M. A. gasoline plant of Continental Oil Co., the Burkburnett plant of Magnolia Petroleum Co., the Mankins plant of Phillips Petroleum Co., the Electra plant of The Texas Co., and the Maden plant of Warren Petroleum Corp. The 40 producing oilfields in Wichita County, including 7 discovery fields, yielded 10.4 million barrels of crude oil. The Wichita County and the K. M. A. fields each produced over 1 million barrels of crude oil. Natural gas produced totaled 9.1 billion cubic feet.

Wilbarger.—The Texas Highway Department mined and prepared gravel for paving purposes. Natural-gas liquids were recovered at the Electra gasoline plant of Magnolia Petroleum Co. and the Rock Crossing plant of W. T. Waggoner estate. Production of 4.1 million barrels of crude oil and 1.1 billion cubic feet of natural gas was reported during the year. The 39 producing oilfields included 5 discovery fields. Wilbarger County oilfield produced over 1 million barrels of crude alone.

Willacy.—The 8 producing oilfields in Willacy County included 4 discovery fields and yielded 2.6 million barrels of crude oil. Willamar West field produced over 1 million barrels of crude oil. Natural-gas production amounted to 7.2 billion cubic feet.

Williamson.—Lime for building plasters and for chemical and industrial uses was manufactured by Round Rock Lime Co. plant at Round Rock. Limestone for manufacturing lime was quarried at pits near the lime plant. Crushed dolomite for refractory purposes was quarried by Superior Stone Products, Inc. Five oilfields yielded 48,000 barrels of crude during the year.

Wilson.—Miscellaneous clay, used for manufacturing building brick and heavy clay products, was mined by W. S. Dickey Clay Mfg. Co. Production of 403,000 barrels of crude oil from 10 oilfields, including 3 discovery fields, and 52.3 billion cubic feet of natural gas was reported in Wilson County during 1954.

Winkler.—Mineral production, consisting of crude oil, natural gas, natural-gas liquids, and recovered elemental sulfur valued at $46.7 million was reported from Winkler County in 1954. Natural-gas liquids were recovered from the Walton-Keystone gasoline plant of Cabot Carbon Co., the Lyman plant of C. V. Lyman, the Kermit plant of Magnolia Petroleum Co., and the Keystone plant of Sid Richardson Gasoline Co. The Kermit channel plant of Cabot Carbon Co. recovered carbon black during the year. Elemental sulfur was recovered at the Keystone gasoline plant of Sid Richardson. The 29 producing oilfields, including 1 discovery field, yielded 14.9 million barrels of crude oil. Five oilfields in the county produced over 1 million barrels each: The Ward, North Estes, the Keystone (Ellenburger), Keystone (Colby sand), the Kermit, and the Hendricks.

Wise.—Crushed limestone used for riprap, metallurgical flux, concrete and road metal, and agricultural purposes was produced by

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the following companies: Southwest Stone Co., Oran Speer Quarry, Wesco Stone Corp., and R. W. McKinney. The Texas Highway Department prepared gravel for paving purposes during the year. Miscellaneous clay was mined by Acme Brick Co. for manufacturing building brick and heavy clay products. Natural-gas liquids were recovered at the Chico gasoline plant of Cities Service Oil Co. In Wise County, 23 producing oilfields, including 11 discovery fields, yielded 405,000 barrels of crude oil. Natural-gas production amounted to 7.1 billion cubic feet.

Wood.—Natural-gas liquids were recovered at the Caska gasoline plant of Caska Corp. and the Hawkins plant of Natural Gasoline Corp. Production of 22.7 million barrels of crude oil from 37 producing oilfields, including 1 discovery field, and 12.6 billion cubic feet of natural gas was reported in Wood County in 1954. Quitman and Hawkins oilfields, each produced over 1 million barrels of crude oil.

Yoakum.—Evaporated salt and salt in brine were produced by Frontier Chemical Co. from wells near Denver City. Natural-gas liquids were recovered at the Wasson gasoline plant of Shell Oil Co. The 18 producing oilfields, including 7 discovery fields, yielded 17.4 million barrels of crude oil. Three oilfields—the Wasson field in Gaines and Yoakum Counties, the Prentice, and the Prentice (6,700 feet) field—each produced over 1 million barrels of crude oil.

Young.—Gravel for paving purposes was prepared by the Texas Highway Department. The oil refinery of G & B Oil Co. at Graham operated throughout the year. Natural-gas liquids were recovered at the Lebus gasoline plant of Lebus Bros., the Southbend and the Peters plants of Nash Gasoline Co., and the Turner and West plants of Turner & West. The 151 producing oilfields, including 8 discovery fields, yielded 6.2 million barrels of crude oil. The Young County field produced over 1 million barrels. Natural-gas production amounted to 4.6 billion cubic feet.

Zapata.—Twelve oilfields in Zapata County produced, in all, 870,000 barrels of crude oil during 1954. Natural-gas production amounted to 2.5 billion cubic feet.

Zavala.—D. N. D. Gravel Co. produced sand and gravel for building and paving purposes. The Del Monte oilfield produced 10,000 barrels of crude during the year. Natural-gas production totaled 1.5 billion cubic feet.

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The Mineral Industry of Utah

By Frank J. Kelly,[1] William H. Kerns,[1]
Breck Parker,[1] and Alfred L. Ransome[2]

THE TOTAL value of mineral production in Utah, excluding uranium, declined to $255 million in 1954 from nearly $299 million in 1953. The 15-percent decline in value was due primarily to the decreased production of copper. Declines in the output of iron ore and coal also were significant factors.

Of the total value of minerals produced in Utah in 1954 (comparable 1953 figures in parentheses), various minerals contributed as follows: Copper 49 percent (52), coal 12 (13), iron ore 8 (9), gold 6 (6), lead 5 (4), zinc 3 (2), and silver 2 (2). As a group, metals supplied 78 percent of the total value in 1954 (80 percent in 1953), nonmetals 7 percent (5 percent in 1953), and mineral fuels 15 percent in both years.

In 1954 Utah was the only producer of natural gilsonite in the United States and again ranked second to Arizona in production of copper, to Colorado in production of molybdenum, and to South Dakota in production of gold. It also continued to be a major producer of lead, potash, iron ore, cement, silver, zinc, clays, and sand and gravel. Some production data for 1954 were collected jointly with the Bureau of the Census, United States Department of Commerce. Production totals will be compared with the Bureau of the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences of coverage.

During the year an average of 13,000 persons was employed in the mining industry in Utah—8,300 in metal mining, 1,500 in nonmetallic and other mining and quarrying, and 3,200 in coal mining. The labor supply was adequate throughout 1954, but production was affected adversely, particularly in the copper industry, as the result of strikes during August and September.

Government assistance to the mining industry continued through the activity of the Defense Minerals Exploration Administration (DMEA). During 1954 five contracts were written for a total of $86,221. Details of the various projects are shown in table 3.

A detailed review of mills, smelters, refineries, and purchase depots active in Utah was given in the Utah chapter of the Minerals Yearbook, volume III, 1953. No significant change occurred in 1954.

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Many ores contain valuable minor constituents such as arsenic, bismuth, cadmium, cobalt, nickel, platinum-group metals, selenium, tellurium, and some minor metals, such as gallium and germanium. These quantities sometimes are not known and sometimes, though known by analyses, are not accounted for metallurgically in early processing stages, or credited to the mine of origin. These minor constituents are recovered at plants, frequently treating mixtures of materials from many sources, including residues from refining of metals such as copper, lead, and others and in other ways. It is not possible in many such instances to distribute the mineral products by State of origin, and in some instances it is even difficult to obtain an accurate separation as to domestic and foreign sources.

TABLE 1.—Mineral production in Utah, 1953–54,[1] excluding uranium

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Asphalt and related bitumens: Gilsonite	60, 505	$2, 184, 328	75, 943	$2, 724, 023
Clays	[2] 188, 348	[2] 1, 447, 515	(3)	(3)
Coal	6, 544, 145	37, 689, 144	5, 007, 952	29, 761, 341
Copper (recoverable content of ores, etc.)	269, 496	154, 690, 704	211, 835	124, 982, 650
Fluorspar	15, 527	374, 944	4, 403	82, 353
Gold (recoverable content of ores, etc.)—troy ounces	483, 430	16, 920, 050	403, 401	14, 119, 035
Iron ore (usable)—long tons, gross weight	4, 617, 288	26, 496, 950	3, 040, 646	19, 277, 434
Lead (recoverable content of ores, etc.)	41, 522	10, 878, 764	44, 972	12, 322, 328
Lime (open-market)	(3)	(3)	30, 428	431, 828
Manganese ore and concentrate (35 percent or more Mn) gross weight	550	(3)	25	(3)
Manganiferous ore and concentrate (5 to 35 percent Mn) gross weight	5, 155	82, 316	97	(3)
Natural gas—million cubic feet	7, 075	807, 000	16, 024	2, 259, 000
Petroleum (crude)—thousand 42-gallon barrels	1, 807	(3)	1, 905	4, 480, 000
Pumice and pumicite	3, 880	4, 385	3, 588	3, 788
Salt	154, 088	772, 035	166, 506	1, 020, 061
Sand and gravel	4, 627, 808	3, 179, 690	5, 327, 969	3, 592, 286
Silver (recoverable content of ores, etc.)—troy ounces	6, 725, 807	6, 087, 195	6, 179, 243	5, 592, 527
Stone	[4] 997, 330	[4] 1, 446, 594	1, 127, 461	1, 545, 841
Tungsten concentrate—60-percent WO_3 basis	35	123, 445	84	308, 634
Vanadium (content of ores, etc.)—pounds	1, 058, 345	(3)	1, 077, 806	(3)
Zinc (recoverable content of ores, etc.)	29, 184	6, 712, 320	34, 031	7, 350, 696
Undistributed: Carbon dioxide (natural), cement, gypsum, molybdenum, natural gasoline, perlite, phosphate rock, potassium salts and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 3)		[2] 28, 732, 045		25, 942, 747
Total Utah		298, 629, 000		[5] 255, 234, 000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers). Value of low-grade manganese ore shipped to General Services Administration purchase depots excluded.
[2] Revised figure.
[3] Value included with "Undistributed."
[4] Excludes stone used for cement and lime.
[5] The total has been adjusted to eliminate duplication in the value of stone.

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TABLE 2.—Average prices of selected mineral commodities in Utah, 1953–54 [1]

Commodity		1953	1954
Coal	short ton	[2] $5.759	$5.943
Copper [3]	pound	.287	.295
Fluorspar	short ton	24.148	18.704
Gilsonite	do	36.102	35.869
Gold [4]	troy ounce	35.000	35.000
Iron ore	long ton	5.739	6.340
Lead [3]	pound	.131	.137
Pumice and pumicite	short ton	1.130	1.056
Salt	do	5.010	6.126
Sand and gravel	do	.687	.674
Silver [5]	troy ounce	.905+	.905+
Stone	short ton	1.450	1.371
Tungsten	short-ton unit contained in 60-percent WO_3 concentrate	57.720	61.346
Zinc [3]	pound	.115	.108

[1] Prices are based on average value f. o. b. mines or mills reported by the producers, except as otherwise noted.
[2] Revised figure.
[3] Yearly average weighted price of all grades of primary metal sold by producers.
[4] Price under authority of Gold Reserve Act of Jan. 31, 1934.
[5] Treasury buying price for newly mined silver July 1, 1946, to date— $0.9050505 ($0.905 used in 1947 for calculating purposes).

TABLE 3.—DMEA contracts in Utah in 1954

Contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation, percent
Big Indian Uranium Corp.	Big Indian Copper mine	Copper	Oct. 25, 1954	$51,260	50
Intermountain Mining, Inc.	Last Chance and Ring Cone.	Uranium	Sept. 21, 1954	9,275	75
Spider Uranium Mining Co., Inc.	Hornet and Delmont	Tungsten	Oct. 5, 1954	1,952	75
United States Uranium Co.	Frying Pan	Uranium	Oct. 4, 1954	17,574	75
Willden & Petty	Brown Queen claim	Tungsten	Aug. 9, 1954	6,160	•75
Total				86,221	60

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METALS

Arsenic.—A small quantity of arsenic was recovered in Utah as a byproduct of lead smelting at the Midvale plant of the United States Smelting, Refining & Mining Co.

Cobalt.—Cobalt was recovered in 1954 at the Howe Sound Co. refinery at Garfield from concentrate shipped from Calera Mining Co. (subsidiary of Howe Sound Co.) property at Cobalt, Idaho. The refinery was operated for the first time in 1953.

Copper.—The output of recoverable copper in Utah in 1954 (211,835 short tons) decreased 21 percent below 1953 (269,496 tons) and was the lowest since 1949. Utah remained the second major copper-producing State in the United States, following Arizona.

Production of copper ore at the Utah Copper (Kennecott Copper Corp.) open pit at Bingham (Salt Lake County) dropped because of less domestic demand in the early part of the year and work stoppages later. Operations were reduced to a 5-day week in March. The demand for copper increased in the second quarter, and production schedules were changed accordingly. Operations again were curtailed by a 2-week labor strike in August. In mid-September a strike that

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lasted a month was called at the Garfield smelter, American Smelting & Refining Co., where concentrate produced at Kennecott's Utah Copper Division is treated. This strike was followed immediately by one at the Kennecott Utah refinery. These strikes caused a substantial reduction in output at the Kennecott Utah Mining Division.

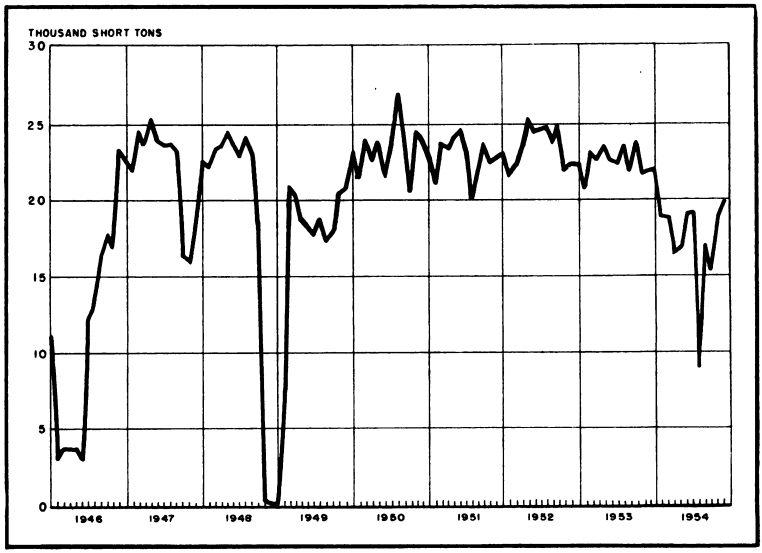

FIGURE 1.—Mine production of copper in Utah, 1946–54, by months, in terms of recoverable metals.

TABLE 4.—Mine production of gold, silver, copper, lead, and zinc, 1945–49 (average), 1950–54, and total 1864–1954, in terms of recoverable metals [1]

Year	Mines producing		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945–49 (average)	101	1	23,217,473	312,531	$10,938,578	6,555,048	$5,615,771
1950	84	2	31,855,601	457,551	16,014,285	7,083,808	6,411,204
1951	82		31,356,837	432,216	15,127,560	7,310,665	6,616,521
1952	63		32,875,034	435,507	15,242,745	7,194,109	6,511,032
1953	55	1	30,682,662	483,430	16,920,050	6,725,807	6,087,195
1954	54		24,846,805	403,401	14,119,035	6,179,243	5,592,527
1864–1954			[3] 799,338,119	13,959,225	388,797,915	776,216,392	575,712,955

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	206,289	$77,265,793	46,050	$12,965,880	37,551	$9,265,903	$116,051,925
1950	278,630	115,910,080	44,753	12,083,310	31,678	8,996,552	159,415,431
1951	271,086	131,205,624	50,451	17,456,046	34,317	12,491,388	182,897,139
1952	282,894	136,920,696	50,210	16,167,620	32,947	10,938,404	185,780,497
1953	269,496	154,690,704	41,522	10,878,764	29,184	6,712,320	195,289,033
1954	211,835	124,982,650	44,972	12,322,328	34,031	7,350,696	164,367,236
1864–1954	6,905,167	2,324,279,671	4,809,668	609,279,518	1,271,001	216,152,667	4,114,222,726

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, old tailings or slimes re-treated, and ore, old tailings, or copper precipitates shipped to smelters during the calendar year indicated.
[2] Does not include gravel washed or tonnage of precipitates shipped.
[3] Figures estimated for certain years before 1901.

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TABLE 5.—Mine production of gold, silver, copper, lead, and zinc in 1954, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	39,037	492,940	21,964	3,154	2,356
February	37,281	519,920	18,921	4,108	2,841
March	39,193	590,109	18,841	4,441	3,123
April	30,474	499,093	16,510	3,805	3,014
May	30,342	499,987	16,951	3,203	2,593
June	37,486	562,763	19,156	3,663	2,686
July	35,926	524,647	19,134	2,736	2,236
August	18,822	430,049	9,024	3,600	2,509
September	30,895	430,833	16,990	3,482	2,634
October	32,821	457,307	15,346	3,487	3,003
November	35,113	586,854	19,073	4,395	3,429
December	36,011	584,741	19,925	4,898	3,607
Total	403,401	6,179,243	211,835	44,972	34,031

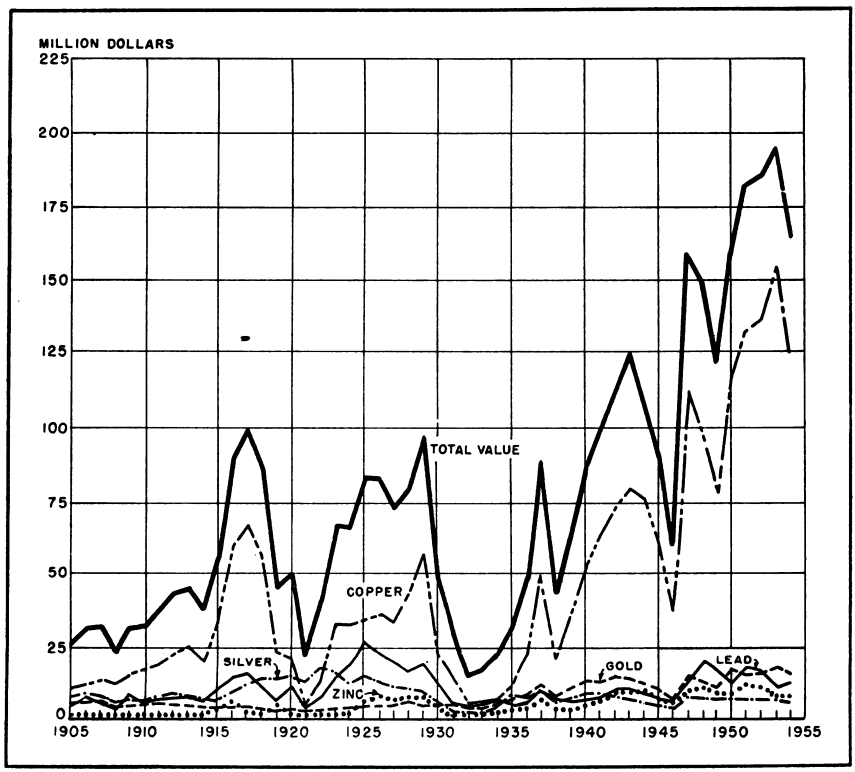

FIGURE 2.—Value of mine production of gold, silver, copper, lead, and zinc in Utah, 1905–54.

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TABLE 6.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties, in terms of recoverable metals

County	Mines producing, lode [1] [2]	Material sold or treated [3] (short tons)	Gold		Silver	
			Fine ounces	Value	Fine ounces	Value
Beaver	7	831	15	$525	1,580	$1,430
Grand	1	120	1	35	200	181
Juab	10	119,629	2,857	99,995	708,946	641,632
Piute	1	74	28	980	4,409	3,990
Salt Lake	6	24,431,909	369,781	12,942,335	4,114,734	3,724,042
San Juan	1	39			15	14
Summit	2	114,823	2,021	70,735	395,420	357,875
Tooele	11	59,603	1,570	54,950	298,692	270,331
Utah	11	32,263	1,244	43,540	224,119	202,839
Wasatch	2	86,938	25,879	905,765	430,850	389,941
Washington	1	533	5	175	232	210
Wayne	1	43			46	42
Total: 1954	54	24,846,805	403,401	14,119,035	6,179,243	5,592,527
1953	[4] 55	30,682,662	483,430	16,920,050	6,725,807	6,087,195

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Beaver	24	$14,160	15	$4,110			$20,225
Grand	3	1,770					1,986
Juab	114	67,260	5,241	1,436,034	4,331	$935,496	3,180,417
Piute	2	1,180	2	548			6,698
Salt Lake	210,650	124,283,500	29,686	8,133,964	20,500	4,428,000	153,511,841
San Juan	2	1,180					1,194
Summit	100	59,000	1,828	500,872	1,749	377,784	1,366,266
Tooele	309	182,310	3,903	1,069,422	2,546	549,936	2,126,949
Utah	45	26,550	693	189,882	4	864	463,675
Wasatch	501	295,590	3,604	987,496	4,901	1,058,616	3,637,408
Washington	83	48,970					49,355
Wayne	2	1,180					1,222
Total: 1954	211,835	124,982,650	44,972	12,322,328	34,031	7,350,696	164,367,236
1953	269,496	154,690,704	41,522	10,878,764	29,184	6,712,320	195,289,033

[1] Operation at tailing or slag dumps and old mill or smelter cleanups not counted as a producing mine.
[2] No placer production in 1954.
[3] Does not include tonnage of precipitate shipped.
[4] 1 placer mine also produced in 1953.

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TABLE 7.—Mine production of gold, silver, copper, lead, and zinc in 1954, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore:							
Dry gold	3	308	82	778	200	7,900	----------
Dry gold-silver	9	4,734	372	20,486	74,250	55,800	100
Dry silver	12	127,927	3,437	688,790	239,080	2,760,900	----------
Total	24	132,969	3,891	710,054	313,530	2,824,600	100
Copper	14	24,088,109	361,660	2,639,162	403,679,400	192,200	----------
Lead	19	11,794	558	67,136	107,770	3,298,400	51,400
Lead-zinc	12	541,683	35,746	2,570,050	3,122,300	81,857,300	65,919,900
Total	40	24,641,586	397,964	5,276,348	406,909,470	85,347,900	65,971,300
Other "lode" material:							
Old tailings [2]	--------	53,675	1,120	164,800	120,700	1,223,700	----------
Copper precipitate	--------	10,359	----------	----------	15,906,900	----------	----------
Old slag, mill cleanings, and smelter cleanings [3]	--------	18,575	426	28,041	419,400	547,800	2,090,600
Total	--------	82,609	1,546	192,841	16,447,000	1,771,500	2,090,600
Total "lode" material [4]	54	24,857,164	403,401	6,179,243	423,670,000	89,944,000	68,062,000

[1] Detail will not add to totals because some mines produce more than 1 class of ore.
[2] Gold-silver, 11,382 tons; silver, 42,293 tons.
[3] Old slag: Copper, 1,605 tons; zinc, 16,940 tons. Mill cleanings: Copper, 26 tons. Smelter cleanings: Lead, 4 tons.
[4] No placer production in 1954.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery and types of material processed, in terms of recoverable metals

Method of recovery and type of material processed	Material treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:						
Concentration and smelting of concentrate [1]	24,620,983	396,928	5,167,817	406,133,900	81,833,800	65,904,300
Direct smelting:						
Ore	153,572	4,927	818,585	1,089,100	6,338,700	67,100
Old tailings	53,675	1,120	164,800	120,700	1,223,700	----------
Copper precipitate [2]	10,359	----------	----------	15,906,900	----------	----------
Old slag, mill and smelter cleanings	18,575	426	28,041	419,400	547,800	2,090,600
Total	236,181	6,473	1,011,426	17,536,100	8,110,200	2,157,700
Grand total [3]	24,857,164	403,401	6,179,243	423,670,000	89,944,000	68,062,000

[1] Ore only; no old tailings, etc., processed by this method in Utah in 1954.
[2] All from Salt Lake County.
[3] No placer production in 1954.

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TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery and classes of material processed, in terms of recoverable metals [1]

A. For ore treated at mills

	Material treated (short tons)	Concentrate shipped to smelters and recoverable metals					
		Concentrate (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES							
Juab	59,436	16,471	812	364,581	81,400	8,253,000	8,635,300
Salt Lake	24,415,952	780,650	368,732	4,035,502	404,884,400	56,799,100	40,984,400
Summit	19,326	4,778	331	74,587	24,800	2,718,600	3,498,000
Tooele	39,774	10,050	1,188	262,753	187,000	6,855,100	2,984,600
Wasatch	86,495	23,208	25,865	430,394	956,300	7,208,000	9,802,000
Total: 1954	24,620,983	835,157	396,928	5,167,817	406,133,900	81,833,800	65,904,300
1953	30,448,505	977,962	477,603	5,896,071	512,370,105	76,645,380	56,266,490
BY CLASSES OF ORE TREATED							
Copper	24,079,400	687,784	361,184	2,598,036	403,012,500		
Lead-zinc	541,583	147,373	35,744	2,569,781	3,121,400	81,833,800	65,904,300
Total 1954	24,620,983	835,157	396,928	5,167,817	406,133,900	81,833,800	65,904,300
BY CLASSES OF CONCENTRATE SHIPPED TO SMELTERS							
Copper		687,784	361,184	2,598,036	403,012,500		
Lead		67,871	27,463	2,073,450	1,949,650	76,602,450	808,350
Lead-zinc		1,182	46	15,298	5,800	140,200	1,308,500
Iron (from lead-zinc ore)		17,627	4,548	77,908	62,520	448,350	399,750
Total to copper and lead plants		774,464	393,241	4,764,692	405,030,470	77,191,000	2,516,600
Zinc concentrates to zinc plants		60,693	3,687	403,125	1,103,430	4,642,800	63,387,700
Total: 1954		835,157	396,928	5,167,817	406,133,900	81,833,800	65,904,300
1953		977,962	477,603	5,896,071	512,370,105	76,645,380	56,266,490

B. For material shipped directly to smelters

	Material shipped (short tons)	Recoverable metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
BY COUNTIES						
Beaver	831	15	1,580	48,000	30,000	
Grand	120	1	200	6,000		
Juab	60,193	2,045	344,365	146,600	2,229,000	26,700
Piute	74	28	4,409	4,000	4,000	
Salt Lake	26,316	1,049	79,232	[3]16,415,600	2,572,900	15,600
San Juan	39		15	4,000		
Summit	95,497	1,690	320,833	175,200	937,400	
Tooele	19,829	382	35,939	431,000	950,900	2,107,400
Utah	32,263	1,244	224,119	90,000	1,386,000	8,000
Wasatch	443	14	456	45,700		
Washington	533	5	232	166,000		
Wayne	43		46	4,000		
Total: 1954	236,181	6,473	1,011,426	[3]17,536,100	8,110,200	2,157,700
1953	250,299	5,818	829,735	[3]26,621,895	6,398,620	2,101,510

See footnotes at end of table.

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TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery and classes of material processed, in terms of recoverable metals [1]—Continued

B. For material shipped directly to smelters—Continued

BY CLASSES OF MATERIAL

Dry gold	308	82	778	200	7,900	----------
Dry gold-silver:						
Crude ore	4,734	372	20,486	74,250	55,800	100
Old tailing	11,382	374	43,818	27,300	514,700	----------
Dry silver:						
Crude ore	127,927	3,437	688,790	239,080	2,760,900	----------
Old tailing	42,293	746	120,982	93,400	709,000	----------
Copper:						
Crude ore	8,709	476	41,126	666,900	192,200	----------
Precipitates	10,359	----------	----------	15,906,900	----------	----------
Old slag and cleanup	1,631	410	21,322	412,500	83,100	----------
Lead:						
Crude ore	11,794	558	67,136	107,770	3,298,400	51,400
Smelter cleanings	4	----------	16	----------	800	----------
Lead-zinc	100	2	269	900	23,500	15,600
Total to copper and lead plants	219,241	6,457	1,004,723	17,529,200	7,646,300	67,100
Zinc: Old slag to zinc plant	16,940	16	6,703	6,900	463,900	2,090,600
Total 1954	236,181	6,473	1,011,426	17,536,100	8,110,200	2,157,700

[1] No bullion produced in 1954.
[2] Includes copper recovered from smelting mine-water precipitate as follows: 1954—15,906,900 pounds; 1953—25,521,370 pounds.

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery and classes of material processed, in terms of gross metal content

Class of material	Quantity shipped or treated (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
CONCENTRATE SHIPPED TO SMELTERS						
Copper	687,784	361,184	2,598,036	411,237,361	----------	----------
Lead	67,871	27,463	2,073,450	2,464,588	79,451,894	8,640,510
Lead-zinc	1,182	46	15,298	6,859	147,628	1,339,381
Iron (from lead-zinc ore)	17,627	4,548	77,908	83,624	460,913	764,768
Total to copper and lead plants	774,464	393,241	4,764,692	413,792,432	80,060,435	10,744,659
Zinc concentrate to zinc plants	60,693	3,687	403,125	1,298,390	4,985,585	65,528,296
Total: 1954	835,157	396,928	5,167,817	415,090,822	85,046,020	76,272,955
1953	977,962	477,603	5,896,071	523,513,420	79,690,007	66,625,776
ORES, OLD TAILING, ETC., SHIPPED DIRECTLY TO SMELTERS						
Dry gold	308	82	778	430	13,278	----------
Dry gold-silver:						
Crude ore	4,734	372	20,486	76,430	91,352	175
Old tailing	11,382	374	43,818	27,849	857,895	----------
Dry silver:						
Crude ore	127,927	3,437	688,790	244,587	4,601,733	1,683
Old tailing	42,293	746	120,982	95,253	1,180,994	----------
Copper:						
Crude ore	8,709	476	41,126	682,734	318,982	----------
Precipitates	10,359	----------	----------	16,149,292	----------	----------
Old slag and cleanup	1,631	410	21,322	421,714	138,592	----------
Lead:						
Crude ore	11,794	558	67,136	143,314	3,425,260	93,928
Smelter cleanings	4	----------	16	----------	894	152
Lead-zinc	100	2	269	1,062	23,885	19,708
Total to copper and lead plants	219,241	6,457	1,004,723	17,842,665	10,652,865	115,646
Zinc: Old slag to zinc plant	16,940	80	12,463	120,433	483,909	2,365,906
Total: 1954	236,181	6,537	1,017,186	17,963,098	11,136,774	2,481,552
1953	250,299	5,888	836,204	27,148,032	9,203,087	2,629,517

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TABLE 11.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties and districts, in terms of recoverable metals

County and district	Mines producing, lode [1] [2]	Material sold or treated [3] (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
Beaver County:								
Beaver Lake	1	541	8	344	32,400			$10,149
Granite	1	4	1	14		1,000		185
Rocky	1	132	4	455	15,000			4,977
Star and North Star	4	154	2	767	600	29,000		4,914
Grand County: Salt Valley	1	120	1	200	6,000			1,986
Juab County:								
Detroit (Drum Mountain)	1	11	3	41	1,100			466
Tintic [4]	9	119,618	2,854	708,905	226,900	10,482,000	8,662,000	3,179,951
Piute County: Mount Baldy	1	74	28	4,409	4,000	4,000		6,698
Salt Lake County:								
Big Cottonwood	1	274	3	1,522	4,200	24,300	23,000	8,534
Little Cottonwood	1	213	18	4,129	8,900	5,500		7,747
West Mountain (Bingham)	4	24,431,422	369,760	4,109,083	421,286,900	59,342,200	40,977,000	153,495,560
San Juan County: Big Indian	1	39		15	4,000			1,194
Summit County: Uintah	2	114,823	2,021	395,420	200,000	3,656,000	3,498,000	1,366,266
Tooele County:								
Blue Bell	1	5		45		3,200		479
Clifton	1	9	1	61		1,700		323
Erickson	2	349	2	225	600	27,900	30,500	7,567
Ophir	2	19,237	74	88,721	150,700	2,317,800	1,505,900	607,520
Rush Valley	3	21,472	1,168	181,653	51,400	4,907,800	1,465,000	1,051,037
Smelter		18,517	299	27,954	414,900	547,000	2,090,600	458,884
Third Term (Grantsville)	1	3		6	400			123
Willow Springs	1	11	26	27		600		1,016
Utah County:								
American Fork	3	45		341	100	15,900		2,517
Tintic [4]	8	32,218	1,244	223,778	89,900	1,370,100	8,000	461,158
Wasatch County:								
Blue Ledge	1	86,495	25,865	430,394	956,300	7,208,000	9,802,000	3,623,024
Snake Creek	1	443	14	456	45,700			14,384
Washington County: Tutsagubet	1	533	5	232	166,000			49,355
Wayne County: Torrey	1	43		46	4,000			1,222
Total	54	24,846,805	403,401	6,179,243	423,670,000	89,944,000	68,062,000	164,367,236

[1] Operation at tailing or slag dumps and old mill or smelter cleanups not counted as a producing mine.
[2] No placer production in 1954.
[3] Does not include tonnage of precipitate shipped.
[4] Tintic district lies in both Juab and Utah Counties.

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The United States & Lark group of the United States Smelting, Refining & Mining Co., also at Bingham, was the second largest copper producer in Utah. Output from this mine and that from the Utah Copper mine contributed 99 percent of the 1954 Utah copper production. The copper output from the United States & Lark mine was recovered from lead-zinc ore concentrated, copper and lead ores, and copper precipitate shipped directly to the smelter. A substantial quantity of copper was recovered from lead-zinc ore mined by New Park Mining Co. from the Mayflower-Galena mine in the Blue Ledge district, Wasatch County.

Gold.—Despite a 17-percent decline in gold production in 1954 (403,400 fine ounces), compared with 1953 (483,400 ounces), Utah continued to rank second to South Dakota in State output in the United States. The 1954 gold output in Utah was the lowest since 1949 (314,100 ounces). Four mines—Utah Copper, Mayflower-Galena, United States & Lark, and Chief No. 1—each produced over 1,000 fine ounces of gold and together furnished 99 percent of Utah gold production in 1954. Of these four, the Kennecott Copper Corp. Utah Copper property was by far the largest producer of gold in the State. A greatly reduced gold output from this mine was largely responsible for the total decline in gold production in 1954. Next in order of gold output were the Mayflower-Galena mine, New Park Mining Co.; United States & Lark, United States Smelting, Refining & Mining Co.; and Chief No. 1, Chief Consolidated Mining Co.

Of the gold produced in Utah in 1954, 90 percent was recovered from copper ore, 9 percent from lead-zinc ore, and the remainder largely from silver ore and old tailing. Ninety-eight percent of the gold was recovered from concentrate smelted and the remainder from ore, old tailing, and cleanup material smelted directly.

Iron Ore.—Production of iron ore from deposits in Utah in 1954 decreased 34 percent, compared with 1953. Shipments consisted of magnetite ore, averaging 50.97 percent natural iron, from 7 mines in Iron County. Some was shipped especially for making cement.

Fewer shipments resulted from a diminishing demand for iron and steel products, mainly from west coast buyers. Because of the decreased demand, the Ironton pig-iron plant, Columbia-Geneva Division, United States Steel Corp., was closed from January to October. Mining operations of the Columbia Iron Mining Co., Iron County, also were affected by the cutback in orders; some men were laid off, and a 40-hour week was adopted. A strike in October at United States Steel Geneva Works also contributed to the decline in output of iron ore.

TABLE 12.—Shipments of usable iron ore from Utah, 1945–49 (average) and 1950–54

Year	Long tons	Value	Year	Long tons	Value
1945–49 (average)	2,399,991	$2,946,601	1952	3,990,505	$15,025,899
1950	3,111,167	5,746,808	1953	4,617,288	26,496,950
1951	4,637,239	10,141,653	1954	3,040,646	19,277,434

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Production of iron ore from Excelsior mine, Utah Construction Co., Iron County, Utah, for the Colorado Fuel & Iron Corp. plant, Pueblo, Colo., was drastically curtailed for 2 months early in 1954, when shipments were suspended to permit reduction of inventories at the CF&I plant. CF&I began developing a new open-pit iron mine at Iron Mountain, which brought to fruition years of planning that began with drilling operations in 1945.

In December the Western Steel Division, United States Steel Corp., began constructing a multimillion-dollar expanded-steel-pipe manufacturing plant near the Geneva Works. The project was scheduled for completion in the spring of 1955. Plant product will be electric-weld pipe up to 30 inches in diameter for transmitting water, natural gas, and petroleum products.

Lead.—Lead production in Utah increased to 45,000 short tons in 1954 from 41,500 tons in 1953, an 8-percent rise. The price of lead dropped from 13.5 cents a pound at the beginning of the year to 12.5 cents by February 18, where it remained until March 9; by October 4 it reached a high of 15 cents, where it stayed for the remainder of the year. The Government long-term stockpile-purchase program for lead and zinc (begun in June) influenced the rise in output and price of lead for the year, especially the increased output in November and December.

The advance in lead output in Utah resulted from reopening 1 major lead-zinc mine and substantially increased production from 4 major producers in the State. The United Park City mines, a consolidation in 1953 of the old Silver King and Park Utah properties by the United Park City Mines Co., was reopened in 1954 after being idle since mid-1952. The United States & Lark property at Bingham, operated by the United States Smelting, Refining & Mining Co., remained by far the largest lead producer in Utah, and its output in 1954 was 2 percent greater than in 1953. Output from the Chief No. 1 mine, Chief Consolidated Mining Co., again the second largest lead producer in the State, was 42 percent above that in 1953. The increase furnished 45 percent of the lead output in the State in 1954. Other lead-producing mines, in order of output, were Mayflower-Galena, New Park Mining Co.; West Calumet, Calumet Mining Co.; and Ophir, McFarland & Hullinger. The 6 mines mentioned above supplied 95 percent of the total lead output in Utah in 1954.

West Mountain (Bingham) district, in Salt Lake County, supplied 66 percent of the State lead output; Tintic district, in Juab and Utah Counties, 12 percent; and Blue Ledge district, in Wasatch County, 8 percent. Ninety-one percent of the lead was recovered from lead-zinc ore, 4 percent from lead ore, 3 percent from silver ore, and 2 percent from gold, gold-silver, and copper ores, old tailings, and cleanup material.

International Smelting & Refining Co. closed its Tooele smelter in July owing to lack of ore and concentrate. The company reopened the concentrator December 1, but the smelter remained idle at the close of the year. However, it was maintained in standby status for operations in 1955.

Manganese and Manganiferous Ores.—In 1954, 25 short tons (gross weight) of manganese ore (35 percent or more Mn), averaging 60.2

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percent manganese, and 97 tons of manganiferous ore (5–35 percent Mn), averaging 25 percent manganese, were mined in Utah and shipped to the Western Electro-Chemical Corp. at Henderson, Nev. In addition, 32 long dry tons of manganese ore, averaging 39.9 percent manganese, and 4,585 long dry tons of manganiferous ore, averaging 25.6 percent manganese, were shipped from deposits in Utah to the Government purchase depots at Butte, Mont., Wenden, Ariz., and Deming, N. Mex. This ore came from 11 mining operations in 7 counties in Utah in 1954. The largest producer, by far, was Fred Staats, from the Staats Manganese mine in Juab County.

Molybdenum.—All molybdenum produced in 1954 in Utah was a byproduct of copper ore from the Utah Copper property of Kennecott Copper Corp. Therefore, a decline in copper output from Utah Copper mine caused a 10-percent reduction in molybdenum output in 1954, compared with 1953. Despite this, Utah continued to be the second largest producer of molybdenum in the United States, following Colorado.

Selenium and Tellurium.—In 1954 some selenium and tellurium were produced as byproducts at the Garfield copper refinery operated by Kennecott Copper Corp.

Silver.—An 8-percent decline in silver output in 1954, compared with 1953, resulted from a major decline in output from the largest producing mine in the State, the Utah Copper. The decline was due to a reduced output of copper ore, from which silver is recovered as a byproduct. Part of the great drop in silver output from the Utah Copper mine was balanced by the increased output from the Chief No. 1 and Mayflower-Galena (New Park) mines. Output from the United States & Lark mine, the second largest silver producer in Utah in 1954, declined slightly. The 4 mines listed above furnished 83 percent of the State silver output in 1954. Copper ore (chiefly from the Utah Copper mine) supplied 42 percent of the silver production, and lead-zinc ore (largely from the United States & Lark mine) another 42 percent.

Tungsten.—A Government price-support and purchase program for domestic tungsten stimulated tungsten development and output in Utah in 1954. Production increased from 2,078 units of WO_3 in 1953 to 5,031 units in 1954. A large part of the output was recovered by H. M. & S. Milling Co. and Salt Lake Tungsten Co. from treating old tailing. In addition, tungsten ore and concentrate from adjoining States and Montana were treated at these mills. The Treasure Mountain Mining Co. was another large producer of tungsten in Utah in 1954. Some tungsten concentrate from Utah was sold to buyers in Bishop, Calif., and some crude ore was shipped to the Getchell custom mill at Red House, Nev. A large part of the output from Utah, including all Salt Lake Tungsten Co. production, was sold to the General Services Administration, Denver, Colo.

Tungsten deposits in the Gold Hill and Clifton areas of Tooele County and the House Mountain district of Millard County were reactivated during 1954. Consolidated Uranium Co. leased 12 tungsten claims in the Clifton district and announced plans for developing and constructing a mill. Park Brighton Mining Co.

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discovered a large vein of scheelite on claims in the Big Cottonwood district of Salt Lake County.

DMEA exploration contracts for tungsten, totaling $8,112, were executed for 2 mining operations in Utah in 1954, with 75-percent Government participation. The contracts were granted to Spider Uranium Mining Co., Inc., for work at the Hornet and Delmont mines and to Willden & Petty for work on the Brown Queen claim.

Uranium.—Uranium prospecting was intense in southeastern Utah during 1954; however, the year also may be cited as one of development and extension of proved areas, with emphasis on tests of underground drilling. In the Big Indian district drilling was active; new areas were tested and ore bodies drilled more thoroughly. At the same time, full-scale production was begun at Mi Vida mine; and others sought access to ore bodies. At the Happy Jack mine, Bronson & Cooper Mining Co. continued underground development, driving faces to ore limits and crosscutting between entries to block out the ore. Similar work was conducted at the Delta mine in Emery County. Other counties reporting activity were Garfield, Grand, and Piute.

Two new buying depots were opened by the Atomic Energy Commission, one at Moab and the other at the Happy Jack mine in White Canyon. Ore-purchasing depots also were operated at Thompson in Grand County, at Marysvale in Piute County, and at the two uranium mills in Salt Lake City and Monticello.

Two DMEA contracts for uranium exploration in Utah, totaling $16,849, were executed in 1954.

Zinc.—Recoverable zinc output in Utah in 1954 increased 17 percent, compared with 1953; but the value increased only 10 percent, owing to a drop in the average weighted price from 11.5 cents a pound in 1953 to 10.8 cents in 1954. The price reached a low of 9.25 cents in February and rose gradually to 11.5 cents on September 15, where it stayed for the remainder of the year.

Most of the zinc output in Utah in 1954 came from lead-zinc ore mined at the United States & Lark mine of the United States Smelting, Refining & Mining Co., the largest producer of zinc in the State. The Mayflower-Galena, New Park Mining Co., and Chief No. 1, Chief Consolidated Mining Co., mines were the second and third largest zinc producers, respectively, in the State, the same as for lead. The reopening of the United Park City lead-zinc mines contributed greatly to the zinc output. Salt Lake, Juab, Wasatch, Tooele, and Summit were the zinc-producing counties. Lead-zinc ore supplied 97 percent of the total zinc output in the State in 1954.

NONMETALS

Cement.—Shipments of cement in Utah furnished the most important source of income to the nonmetallic segment of the mineral industry. Plants operated by the Union Portland Cement Division, Ideal Cement Co., at Devils Slide, and the Portland Cement Co. of Utah at Salt Lake City were responsible for all production and sales of types I, II, and III and oil-well, waterproof, and masonry cements, which in total gained 14 percent over 1953. Limestone, clay, gypsum,

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and other raw materials used in manufacturing cement were mined locally.

Both plants used the wet process and consumed 35.6 million kilowatt-hours of electrical energy. Four kilns were operated during the year. In addition to the cement consumed in Utah, shipments were made to Arizona, Colorado, Idaho, Nevada, Ohio, Oregon, and Wyoming.

Clays.—The demand for Utah clay for refining oil and manufacturing building brick and other structural clay products continued to climb in 1954, and the output increased significantly over 1953. The most important mining operation was the Dragon halloysite mine at Eureka, Juab County, operated by the Dragon Consolidated Mining Co. until March 16, when it was leased to the Filtrol Corp. of Los Angeles, Calif. Filtrol also operated a processing plant at Salt Lake City, where the halloysite was prepared for catalytic cracking units at petroleum refineries.

Four brick plants were operated in Utah during 1954—2 at Salt Lake City, 1 at Ogden, and 1 at Provo. With the exception of 29,000 tons of fire clay produced in Utah by Utah Fire Clay Co., Western Fire Clay Co., and R. D. Wadley Clay Co., the bulk of the State output was miscellaneous clays. The second and third most important producers, also operating brick plants at Salt Lake City, were the Interstate Brick Co., with miscellaneous clay mines in Morgan, Salt Lake, Tooele, and Utah Counties, and the Utah Fire Clay Co., which mined fire and miscellaneous clays in Summit, Tooele, and Utah Counties.

An average of 139 men was employed in clay mining in the State. Working time ranged from 30 to 300 days, depending on the mining operation.

Fuller's earth and bentonite production was continued in Sevier County by the Western Clay & Metals Co. After being ground at the company mill, the fuller's earth was shipped to refineries for filtering mineral oils and greases. The bentonite was used in foundries and laundries and in concrete and rotary-drilling mud.

Fluorspar.—The output of fluorspar from domestic mines trended downward, and sales of metallurgical-grade fluorspar dropped from 15,527 tons in 1953 to 4,403 tons in 1954. Three mines—the Bell Hill, Lost Sheep, and Fluoride Queen—operated by Bell Hill Mining Co., Willden Bros., and G. P. Spor & Sons, respectively, all in Juab County, were active in 1954. All output was shipped to steel plants. The fluorspar deposits of Utah are described in a Federal Geological Survey publication.[3]

Gypsum.—In 1954, as in 1953, all gypsum produced in Utah came from open pits near Sigurd, Sevier County, operated by United States Gypsum Corp. and Western Gypsum Co. Shipments increased slightly over 1953. The crude gypsum was processed in plants at Sigurd for manufacturing Keene's cement, wallboard, plaster, and other building materials.

Lime.—Lime was produced at three plants in 1954. Of the total production, 70 percent was produced at a plant in Magna, Salt Lake

[3] Thurston, W. R., Staats, M. H., Cox, D. C., and others, Fluorspar Deposits of Utah: Geol. Survey Bull. 1005, 1954, 53 pp.

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County, and used as a reagent in milling copper ore. The remainder was quicklime and hydrated lime produced at plants in Tooele and Utah Counties and used mainly as a reagent in milling base-metal ores. However, significant quantities also were used in making silica brick, as a fluxing agent, and for petroleum refining and water purification and softening.

Perlite.—Following a 2-year decline, the production of perlite in Utah in 1954 increased somewhat. The only producer of crude perlite was Utco Products Co.; the perlite was mined in Beaver County, expanded at the Salt Lake City plant of Utco Products, and used as a plaster and concrete aggregate. Another plant was operated in 1954 at Bauer, Tooele County, by Combined Metals Reduction Co. for processing crude material mined near Pioche, Nev.

Phosphate Rock.—Production of phosphate rock in Utah has been reported intermittently since 1941, but 1954 was the first year in which output had national significance. All 1954 production was from Rich County. The substantial gain in production was due largely to accelerated mining operations at properties of the San Francisco Chemical Co. In addition, the J. R. Simplot Co. began mining near Rex Peak and shipping processed rock to the Victor Chemical Works near Butte, Mont. Garfield Chemical & Manufacturing Co. mined a small quantity of phosphate during the first half of 1954 but suspended operations during the second half of the year. Production by Pearl Phosphate Co. and John M. Uren was suspended temporarily.

All crude material mined by San Francisco Chemical Co. was shipped to the company beneficiating plant at Leefe, Wyo., for processing, and a large portion of the total output was sold to Western Phosphates, Inc., at Garfield.

A $5 million plant completed by Western Phosphates in 1953 helped the economy of the State by necessitating an increased output of phosphate rock. The facility was rated at 90,000 tons of phosphate chemicals annually—mostly triple superphosphate manufactured by combining western phosphate rock and sulfuric acid from the nearby plant of the Garfield Chemical & Manufacturing Co. In addition, a substantial quantity of nitrogen phosphate fertilizer will be produced. Production of a third product, phosphoric acid, will be small; however, the output is expected to climb, as Western Phosphates announced that it plans a 50-percent increase in the output of triple superphosphates and ammonium phosphates from its Garfield plant.

A bibliography of the western phosphate field was published by the Federal Geological Survey.[4]

Potash.—Sales of potassium chloride (95–98 percent KCl) in 1954 declined slightly from 1953, but production increased. Bonneville, Ltd., continued to be the only producer in the State, and all output resulted from the treatment of potassium-bearing brines of the Salduro Marsh on the Bonneville salt flats.

Pumice and Pumicite.—The output of pumice in Utah in 1954 remained relatively static, despite a decline in the number of active mines from 3 in 1953 to 2 in 1954. The Harborlite Corp. was active

[4] Harris, Robert A., Davidson, David F., and Arnold, Bertha P., Bibliography of the Geology of the Western Phosphate Field: Geol. Survey Bull. 1018, 1954, 89 pp.

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at Faust, Tooele County, and shipped a small quantity of crude pumice to its California processing plant for the production of filter and filler materials. William H. Prince & Sons Block Co. was the largest producer, and all output was consumed in manufacturing concrete blocks.

Salt.—Salt ranked sixth in value of nonmetals and furnished 6 percent of the total value of all nonmetals. Productive activity was concentrated in Salt Lake County, where the Morton Salt Co. operated its solar-evaporation facilities on the shores of Great Salt Lake. The Deseret Salt Co. and Stansbury Salt Co., Inc., also produced solar-evaporated salt. Tooele County was the second most important producing area, and Sanpete and Sevier Counties also reported the production of rock salt.

As a result of increased demand for salt in the Rocky Mountain area, output advanced from 154,000 tons in 1953 to 166,000 tons in 1954, a gain of 8 percent. Sales of salt for livestock feed furnished the bulk of shipments, but other important uses, aside from human consumption, were in processing metals, ice manufacturing cold storage, oil-well drilling, and meat packing and as a water softener.

Sand and Gravel.—The demand for sand and gravel in Utah for building and highway construction continued strong, and output in the State rose to 5.3 million tons, a 15-percent increase over 1953. Of the total output, 3.4 million tons, valued at $2.6 million, was produced by private contractors for the local commercial market; and 1.9 million tons, valued at $1 million, was produced by Government construction and maintenance crews and private contractors engaged in highway construction. The largest single consumer of sand and gravel was the Utah State Road Commission. Approximately 400 men were employed in quarrying and preparation, and employment ranged from 24 to 362 days (average, 250 days). The demand for commercial sand and gravel was greatest in the populated regions of the State. Salt Lake County was the largest producing area with 2.3 million tons (43 percent of the total output), followed by Davis and Utah Counties. Sand and gravel was produced in 25 of the 29 counties in Utah.

TABLE 13.—Production of sand and gravel, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	2,271,347	$1,361,397	1952	3,260,044	$2,350,412
1950	3,435,277	2,251,515	1953	4,627,808	3,179,690
1951	2,971,268	2,268,750	1954	5,327,969	3,592,286

Stone.—The production total of stone in Utah in 1954 is not strictly comparable with that reported in 1953, as limestone used in manufacturing cement and lime was included in the 1954 total. The stone output, excluding limestone for cement and lime, declined substantially in 1954, compared with 1953. Commercial crushed-limestone production, excluding limestone for cement and lime, had the largest decrease, dropping from 765,000 tons in 1953 to 625,000 in 1954. A decline also was reported in commercial crushed sandstone, and no

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miscellaneous stone was quarried in 1954, compared with 16,000 tons in 1953. The output of dimension sandstone increased slightly, and 148 tons of dimension granite was sold as monumental stone.

The decline in total stone output resulted from several causes: Sales of limestone for refining sugar remained relatively stable, but the output of limestone as a flux decreased 20,000 tons, and refractory uses dropped 10,000 tons, compared with 1953. A diminishing demand for stone used for riprap, railroad ballast, and dust for coal mines also was reported.

The leading producers of limestone were the Columbia-Geneva Steel Division, United States Steel Corp.; Union Portland Cement Division, Ideal Cement Co.; Utah Lime & Stone Co.; Portland Cement Co. of Utah; and American Smelting & Refining Co.

Sulfur.—The American Sulphur & Refining Co. began constructing a plant to recover sulfur from a deposit at Sulphurdale, Beaver County. The company also had an option on an additional 7,000 acres. The new refinery was expected to begin operating in January 1955 and to use a solvent-recovery method for a planned daily production of 100 tons of refined crystalline sulfur.

Sulfuric acid has been produced at the Garfield smelter of the American Smelting & Refining Co. since 1915, when the Utah Copper Co. and AS&R agreed to construct jointly a plant to supply acid for the flotation circuit at the Utah Copper Magna and Arthur mills and for leaching copper from various ores and dumps.

From time to time, because of the increasing demand for acid, plant capacities were expanded; and, as late as 1952, construction was begun on the fourth plant, which increased the rated capacity of the 4 units to 23,000 tons per month. The sulfuric acid produced at Garfield was consumed as follows: Fertilizers 41 percent, uranium 25 percent, petroleum 13 percent, steel 11 percent, and miscellaneous 10 percent (copper and cadmium refineries, the sugar industry, explosives, leaching plants, and numerous small chemical plants).

Talc.—A mill for processing crude talc was operated in 1954 at Ogden by Tri-State Minerals Co., a wholly owned subsidiary of Southern California Minerals Co. The crude material was mined at the Treasure State and Smith-Dillon mines near Dillon, Mont., and shipped to Ogden. The ground talc was used mainly in manufacturing ceramics, paint, and textiles.

Vermiculite.—Although no crude vermiculite was mined in Utah in 1954, the demand for this mineral commodity for insulation, concrete, and plaster aggregate was satisfied by an exfoliated-vermiculite plant at Salt Lake City operated by Vermiculite-Intermountain, Inc.

MINERAL FUELS

Asphalt and Related Bitumens.—Gilsonite was produced from deposits in Duchesne and Uintah Counties and showed a 25-percent increase over the preceding year. American Gilsonite Co. was reported to be testing processes to make metallurgical coke from gilsonite.

Carbon Dioxide.—Production of natural carbon dioxide gas from Farnham dome in Carbon County remained essentially the same as in

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1953. Gas was produced from the Navajo sandstone at a depth of 2,800 feet. Carbon dioxide gas also occurs in the Gordon Creek field, Carbon County, at depths of 11,000 to 12,000 feet, in the Sinbad limestone member of the Moenkopi formation and in the Coconino sandstone. The Gordon Creek field has been shut in since its discovery in 1948.

Coal.—Production of coal in Utah fell sharply during the year from 6.5 million tons in 1953 to 5 million in 1954. Sixty percent of the decline was due to cutbacks in steel and pig-iron production and the resulting lower demand for blast-furnace coke. Coke ovens in California and Utah, producing almost entirely for blast furnaces in these States, usually consume about 40 percent of the total coal output from Utah. In 1954, 1.9 million tons of Utah coal was delivered to coke-oven plants, compared with 2.8 million tons in 1953.

TABLE 14.—Production of coal, 1953–54, by counties, in short tons [1]

County	1953		1954	
	Production	Average value per ton [2]	Production	Average value per ton [2]
Carbon	4,749,123	$5.82	3,620,663	$6.35
Emery	1,669,445	5.65	1,294,106	4.89
Garfield	1,418	4.75	(3)	(3)
Grand	1,983	5.00		
Iron	31,241	4.49	33,701	4.78
Kane	1,905	6.58	(3)	(3)
Sevier	66,099	5.53	(3)	(3)
Summit	21,931	3.34	(3)	(3)
Uintah	1,000	6.87	(3)	(3)
Other counties			59,482	4.83
Total	6,544,145	5.76	5,007,952	5.94

[1] Excludes mines producing less than 1,000 net tons annually.
[2] Value received or charged for coal f. o. b. mine, including selling cost. Includes a value for coal not sold but used by producer, such as mine fuel and coal coked as estimated by producer at average prices that might have been received if such coal had been sold commercially.
[3] Included in "Other counties"; not published to avoid disclosure of individual operations.

The average number of coal miners employed in the State dropped from 3,850 in 1953 to 3,130 in 1954. In Carbon County unemployment increased from 400 during January and February to 1,000 during May, as mines cut production and were idled temporarily.

During the year 55 mines were active; 46 were in Carbon and Emery Counties. The major producers were the Columbia-Geneva Steel Division, United States Steel Corp. (Columbia and Geneva mines); Kaiser Steel Corp. (Sunnyside Nos. 1, 2, and 3 mines), Independent Coal & Coke Co. (Kenilworth, Castle Gate No. 2, and Clear Creek No. 3 mines), and United States Fuel Co. (King mine). These 4 organizations operated 9 mines and produced 3.3 million tons of coal. An additional million tons came from 7 other operations, and the remaining 0.7 million was produced from 39 smaller mines.

Natural Gas.—The marketed production of natural gas increased sharply in 1954 to 16 billion cubic feet, more than double the output in 1953. The average wellhead price increased from 11.4 to 14.1 cents per thousand cubic feet, and the value of natural-gas production rose from $0.8 million to $2.3 million in 1954.

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The major source of increased gas production was the wells of the Clear Creek field in Carbon and Emery Counties. In the fall of 1953 Clear Creek gas began entering the major consuming area in the State through a new 18-inch gasline from the field to Provo and Salt Lake City. Natural gas also was produced from the Clay Basin field in Daggett County and from the South Cisco field, Grand County, where it was used to a small extent in the town of Cisco.

The total consumption of natural gas increased from 34.6 billion cubic feet in 1953 to 41.1 billion cubic feet in 1954. Electric utilities were primarily responsible for the increase, as consumption by utilities jumped from 0.5 to 6.3 billion cubic feet.

Imports of natural gas from Wyoming and Colorado dropped 2.3 billion cubic feet, and Clay Basin production declined, as it was supplanted by Clear Creek gas.

One new gas discovery in Grand County was completed, and eight development wells were added in Carbon, Emery, and Grand Counties.

The Federal Power Commission approved construction plans for the Pacific Northwest pipeline during the year.

Natural-Gas Liquids.—Production of natural gasoline, recovered from natural gas, dropped to one-sixth that in 1953.

Petroleum.—Production of petroleum rose to 1.9 million barrels in 1954, a 5-percent advance over 1953. The increased output came from the Red Wash and Walker fields and the newly discovered Brennan Bottom field, all in Uintah County, and more than offset declines in the other fields in Uintah and Duchesne Counties.

TABLE 15.—Wildcat and development completions in 1954, by counties

[Oil and Gas Journal]

County	Oil	Gas	Dry	Total	Footage
Wildcat completions:					
Box Elder			2	2	7,700
Carbon	1		1	2	8,200
Daggett			1	1	12,000
Duchesne			2	2	12,700
Emery			8	8	36,300
Garfield			1	1	5,600
Grand	2	1	19	22	55,600
Juab			1	1	3,500
Kane			3	3	17,400
San Juan	1		9	10	65,600
Sanpete			4	4	15,600
Summit			1	1	6,500
Uintah	1		6	7	39,100
Utah			1	1	7,700
Total wildcats	5	1	59	65	293,500
Development completions:					
Carbon		6	1	7	35,100
Emery		1	3	4	21,400
Grand	3	1	8	12	10,200
Uintah	2		1	3	16,400
Total developments	5	8	13	26	83,100
Total all drilling	10	9	72	91	376,600

Drilling increased in 1954, with more emphasis on wildcatting, and activity shifted southward into Grand and San Juan Counties. Most notable of the oil discoveries appeared to be Desert Creek field (Shell

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Oil Co.) in the Paradox basin, San Juan County, and Brennan Bottom field (Gulf Oil Corp.) in the Uintah basin, Uintah County.

Five refineries were operated throughout the year—4 in the Salt Lake City area and 1 at Jensen, Uintah County. At year end the daily operating crude-oil-refining capacity of the 5 plants was 77,500 barrels.

REVIEW BY COUNTIES

Beaver.—The value of the mineral production in Beaver County in 1954 dropped to less than half that in 1953, as the output of sand and gravel dropped from $41,163 to nothing in 1954. The sand and gravel output in 1953 was used for constructing and maintaining county roads and highways. The decline was partly offset by the increased output of gold, silver, copper, and lead from 7 mines in 1954, compared with 4 in 1953. The OK mine in the Beaver Lake district and the North Star Metal mine in the Rocky district were the major producing mines of these metals in 1954.

Utco Products Co. continued to operate its perlite mine in Beaver County in 1954, and the output was slightly larger than in 1953. The crude material was trucked to the company expanding plant at Salt Lake City, and the finished product was used in plaster and concrete aggregate.

Tungsten output from the county dropped from 74 units, valued at $4,442, in 1953 to 18 units, valued at $1,113, in 1954. It was produced by the Little May Mining Co. from the Milford Lilly mine.

Box Elder.—Sand and gravel was the major product and, except for a few tons of tungsten, the only source of income to the mineral industry of the county. Of the 489,000 tons of sand and gravel produced in 1954, 343,000 tons was produced by construction and maintenance crews of the county highway department and private contractors engaged in road projects for the county highway department and the Utah State Road Commission. Some commercial output was reported by the Fife Construction Co., Allen C. Hunsaker, and Jensen Sand & Gravel Co.

Tungsten was produced by six mining operations in the county in 1954. The largest producer was Louise & David Garrick, from the Scheelite Queen mine, which had a recoverable output of 186 short-ton units of WO_3.

Cache.—Stone and sand and gravel comprised the output of mineral commodities in Cache County in 1954. Crushed limestone, quarried at the Providence pit of the Amalgamated Sugar Co., supplied all the county production of stone, which was used solely in refining sugar. The production of sand and gravel, however, resulted from the demand for aggregate for commercial use and requirements of highway contracts let by the county highway department and the Utah State Road Commission. Of the 173,000 tons of sand and gravel sold or used in 1954, 99,000 tons (57 percent) was used for the construction and maintenance of highways.

Carbon.—Coal was the most important mineral commodity, and the coal-mining industry of Carbon County, which produces three-fourths of the State output, felt strongly the decline in the demand for coal. The average number of men employed fell from 2,940

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TABLE 16.—Value of mineral production in Utah, 1953–54, by counties [1] [2]

County	1953	1954	Minerals produced in 1954 in order of value
Beaver	$58,112	$28,524	Copper, perlite, lead, silver, tungsten, gold.
Box Elder	393,315	265,238	Sand and gravel, tungsten.
Cache	388,181	289,923	Stone, sand and gravel.
Carbon	[3] 27,696,885	23,016,211	Coal, sand and gravel, carbon dioxide.
Daggett	[3] 15,974	----------	
Davis	342,894	317,814	Sand and gravel.
Duchesne	[3] 266,742	124,262	Petroleum, sand and gravel.
Emery	[3] 9,483,542	6,397,253	Coal, sand and gravel.
Garfield	6,736	(4)	Coal.
Grand	30,142	23,039	Sand and gravel, copper, silver, gold.
Iron	26,566,642	19,563,121	Iron ore, coal, sand and gravel, stone.
Juab	[3] 3,766,181	4,974,395	Clays, lead, zinc, silver, gold, fluorspar, copper, stone, sand and gravel, manganiferous ore and concentrate, tungsten.
Kane	78,935	75,876	Sand and gravel, coal.
Millard	[3] 109,170	95,073	Tungsten, sand and gravel.
Morgan	3,539,691	4,565,101	Cement, stone, clays, sand and gravel.
Piute	8,018	7,098	Silver, copper, gold, lead, sand and gravel.
Rich	(4)	(4)	Phosphate rock, sand and gravel.
Salt Lake	206,470,524	172,655,426	Copper, molybdenum, gold, lead, zinc, silver, sand and gravel, cement, salt, lime, tungsten, stone, clays.
San Juan	57,085	1,370	Copper, sand and gravel, silver.
Sanpete	41,865	44,095	Salt, stone, sand and gravel.
Sevier	1,219,605	1,136,223	Gypsum, coal, sand and gravel, clays, salt.
Summit	932,441	1,566,833	Lead, zinc, silver, sand and gravel, gold, copper, coal, clays, stone.
Tooele	[3] 4,390,823	4,234,666	Potash (K_2O), lead, zinc, stone, silver, salt, copper, clays, lime, gold, tungsten, sand and gravel, manganese ore and concentrate, pumice and pumicite.
Uintah	(4)	(4)	Petroleum, sand and gravel, coal.
Utah	1,068,415	1,376,351	Stone, sand and gravel, silver, lead, clays, lime, gold, copper, pumice and pumicite, zinc.
Wasatch	3,728,751	3,703,658	Zinc, lead, gold, silver, copper, sand and gravel.
Washington	85,935	84,560	Copper, sand and gravel, stone, silver, gold.
Wayne	----------	1,222	Copper, silver.
Weber	204,892	307,899	Sand and gravel, clays.
Undistributed	[3] 7,797,944	10,940,708	
Total	[3] 298,629,000	[5] 255,234,000	

[1] Value data of gilsonite, natural gas, natural gasoline, some sand and gravel (1954), and vanadium are excluded from county totals and included with "Undistributed" to avoid disclosure of individual company operations.
[2] Value of low-grade manganese ore shipped to General Services Administration purchase depots and uranium ore is excluded.
[3] Revised figure.
[4] Value included with "Undistributed" to avoid disclosure of individual company operations.
[5] The total has been adjusted to eliminate duplication in the value of stone.

in 1953 to 2,360 in 1954; however, during the late spring 1,000 men were reported idle owing to temporary shutdown.

Natural-gas production from the Clear Creek field, which extends into Emery County, increased substantially during the year and supplied three-quarters of the marketed production of the State. Development of the field was carried out by Three States Natural Gas Co. and Phelps Dodge Corp.; however, a decline in reservoir pressure caused delay and curtailment of further work.

The Jack Canyon field was discovered by El Paso Natural Gas Co., and 30 barrels of oil was produced daily from the lower Green River formation.

Carbon dioxide production was reported from wells at Farnham dome.

Sand and gravel was the only nonmetal produced in the county during 1954, and the output dropped from 32,000 tons in 1953 to 18,000 tons in 1954.

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Daggett.—Marketed production of natural gas from the Clay Basin field was curtailed in 1954, as gas from the Clear Creek field in Carbon and Emery Counties was fed into the Salt Lake City consuming area. The Mountain Fuel Supply Co. natural-gas system has been for many years the only supplier of gas to Salt Lake City, the gas being produced from Clay Basin and other fields of the Green River basin in Wyoming and Colorado.

Davis.—Oil refining at two plants, Phillips Petroleum Co. at Woods Cross and Western States Refining Co. at North Salt Lake, continued to be by far the principal activity of the mineral industry of the county. Most of the crude petroleum that supplied the plants was from fields in northwest Colorado and northeast Utah and western Wyoming.

The demand for sand and gravel by the construction industry of Salt Lake and Davis Counties and the need for aggregate for road construction resulted in a further increase in the output of this commodity in 1954. Sales rose from 430,000 tons in 1953 to 486,000 tons in 1954, a gain of 13 percent. The bulk of the output, 427,000 tons, was consumed by the construction industry in private construction. The principal producers were White Hill Sand & Gravel Co., Inc., Clarence Waterfall Co., and A–1 Sand & Gravel Co. The remainder of the output was Government-and-contractor and resulted from contracts let by the county highway department and Utah State Road Commission.

Duchesne.—Petroleum production from the county, Duchesne and Flat Mesa fields, dropped to 51,000 barrels in 1954. No development drilling was reported during the year, and only two wildcats were completed, as drilling interest shifted to other areas.

Emery.—Emery County was the second most important coal-producing county in Utah, and, as in Carbon County, coal production and employment declined. Production from the 19 operations in the county fell to 1.3 million tons and average employment from 835 in 1953 to 710 in 1954.

Natural gas was produced from the Clear Creek field of Carbon and Emery Counties (see Carbon County).

Drilling activity increased over previous years, with 8 wildcat and 4 development wells. Only 1 of the 12 wells was successful, the Three States Natural Gas Co. well in the Clear Creek field.

The principal uranium activity centered in the San Rafael Swell and Green River areas. In the San Rafael area most of the production came from the Delta and Lucky Strike No. 2 mines and the Temple Mountain district mines. The Delta mine was discovered and developed by Vernon J. Pick, prospector, who sold his controlling interest in 1954 to the Atlas Corp., which then formed the Hidden Splendor Mining Co. to operate the property. The major operator in the Temple Mountain area was Consolidated Uranium Mines, Inc.

In the Green River area ore bodies were discovered in the Salt Wash member of the Morrison formation, and at year end shaft sinking to several of the ore bodies was well under way. Four Corners Uranium Corp. was one of the more active firms in the area.

Garfield.—Uranium-exploration activities were concentrated in two areas: Shinarump formation outcrops were examined and explored in the Circle Cliffs, and the Morrison formation was prospected ex-

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tensively along the eastern flanks of the Henry Mountains near Trachyte Wash. Reserves in these areas were not enough to justify local stockpiling by the AEC, and high transportation costs made much of the ore uneconomic.

Grand.—Oil- and gas-drilling activities took a sharp upswing in 1954, and 34 of the 91 wells drilled in the State were in Grand County. The wells were shallow; exploration wells averaged 2,500 feet and development wells less than 1,000 feet.

A discovery near Cisco by the D & N Mining Co. flowed 27 barrels of oil per day from the Morrison formation at 600 feet. Following this discovery, 25 to 30 shallow holes were drilled in the area by independent operators hoping to find low-cost oil. The results were discouraging, as successful wells flowed at a very low rate.

A natural-gas discovery was made by D. W. Hancock in the Bar–X area. The new field, West Bar–X, flowed 3.6 million cubic feet daily during initial tests of the discovery well.

Important areas of uranium activity and production were as follows: The Thompson area, 15 miles southeast of the town of Thompson; the western portion of the Gateway district along the Utah-Colorado border, west of Gateway, Colo.; the La Sal district, 10 miles northwest of La Sal; and the area 12 miles northwest of Moab. Deposits in these areas are in the Morrison formation. In the southwestern corner of the county prospecting of the Mossback member of the Chinle formation was conducted along the east-side tributaries of the Green River.

At Thompson the United States Vanadium Corp. operated a uranium-ore-buying depot.

Iron.—The decline in the total value of the mineral production in Iron County from $26.5 million in 1953 to $19.5 million in 1954 was due principally to the drop in output of iron ore. The value of iron-ore shipments furnished 99 percent of the total value of mineral output in the county in 1954. A total of 3 million tons of iron ore, averaging 50.97 percent natural iron, was shipped from 7 mines. The largest producer was the Columbia Iron Mining Co., which mined ore from the Desert Mound and Iron Mountain mines. Utah Construction Co. (Excelsior mine), Colorado Fuel & Iron Corp. (Blowout, Comstock, and Duncan mines), and Helene E. Beatty (Great Western mine) were the other iron-ore producers in the county in 1954.

Output of nometallics in Iron County increased from $29,000 in 1953 to $125,000 in 1954, mainly owing to an increase in the output of sand and gravel used in highway construction and commercial sales of crushed and dimension sandstone. Construction and maintenance crews of the Utah State Road Commission produced 4,000 tons of paving gravel, and contracts let by the Federal Bureau of Public Roads resulted in the production of 71,000 tons of paving gravel by private contractors. Willard B. Thompson reported sales of 1,900 tons of crushed sandstone for roofing granules, and the Bear Valley Stone Corp. produced 8,000 cubic feet of dressed building sandstone.

Juab.—The total value of the mineral production in Juab County increased 32 percent in 1954, compared with 1953, from $3.8 million in 1953 to nearly $5 million in 1954. The total value of the gold, silver, copper, lead, and zinc output advanced from $2,178,000 in 1953 to $3,180,000 in 1954. Increased output of lead and zinc fur-

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nished most of the gain and resulted from a stepped-up production from the Chief No. 1 mine, the second largest lead producer, third largest zinc and silver producer, and the fourth largest gold producer in the State. The Chief Consolidated Mining Co. reported that 59,436 tons of lead-zinc ore was mined from the Chief No. 1 and concentrated at the custom-milling plant at Midvale. In addition, 641 tons of lead ore and 49,824 tons of siliceous silver ore were mined and shipped to the Midvale and Tooele lead smelters and to the Garfield copper smelter, respectively. Combined, the ore contained 812 fine ounces of gold, 364,581 ounces of silver, 51 tons of copper, 4,307 tons of lead, and 5,140 tons of zinc. The company also produced silver ore from the American Star mine and gold-silver and lead ore from the Eureka Hill mine for direct smelting. E. J. Longyear Co., which began diamond drilling at Eureka in the Homansville area on properties acquired under a *unit lease* arrangement from Chief Consolidated Mining Co., Tintic Standard Mining Co., United States Smelting, Refining & Mining Co., and others, had completed one hole to a depth of 1,069 feet and had drilled to a depth of 804 feet on the second hole by the end of 1954.

TABLE 17.—Mine production of gold, silver, copper, lead, and zinc in Tintic district, Juab and Utah Counties, 1945–49 (average), 1950–54, and total 1869–1954, in terms of recoverable metals

Year	Mines producing	Material (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Total value
1945–49 (average)	20	159,374	12,772	964,099	400	5,596	4,074	$3,979,278
1950	18	189,870	3,277	924,722	149	6,520	5,985	4,474,031
1951	15	193,123	4,982	944,818	208	5,553	3,410	4,292,771
1952	15	124,442	2,942	666,345	133	4,279	2,951	3,127,613
1953	14	123,301	3,264	580,209	104	3,693	2,433	2,226,060
1954:								
Juab County	9	119,618	2,854	708,905	114	5,241	4,331	3,179,951
Utah County	8	32,218	1,244	223,778	45	685	4	461,158
Total 1954	17	151,836	4,098	932,683	159	5,926	4,335	3,641,109
Total 1869–1954	--------	[1] 16,164,962	2,638,461	266,978,842	123,440	976,712	67,343	425,232,581

[1] Figures estimated for certain years before 1901.

In addition to the Chief, Eureka Hill, and American Star mines operated by Chief Consolidated Mining Co., seven other mines produced varying quantities of gold, silver, copper, lead, and zinc. Of the seven, the Centennial-Beck-Victoria-Gold Hill mines operated by Brennan Hannifin, the Empire mines operated by Empire Mines Co., and the Tetro mines operated by Plutus Mining Co. (subsidiary of Chief Consolidated Mining Co.) were the largest producers.

Clays, fluorspar, stone, and sand and gravel comprised the nonmetals in Juab County in 1954, and the value of output rose from $1.6 million in 1953 to $1.8 million in 1954. Clay was the most important commodity produced by the mineral industry of the region, and the entire output was produced from the Dragon halloysite mine near Eureka. The mine was operated by Dragon Consolidated Mining Co. until March, when the property was leased to Filtrol Corp. Mining activity was intensified in 1954, and output rose 20 percent

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above 1953. All crude material was shipped to the Filtrol processing plant in Salt Lake County.

Shipments of fluorspar continued to decline in 1954. Sales of metallurgical-grade fluorspar dropped to 4,400 tons in 1954, compared with 15,400 tons in 1953. Bell Hill Mining Co. (Bell Hill mine), Willden Bros. (Lost Sheep mine), and G. P. Spor & Sons (Fluoride Queen mine) were the only operators reporting production, and all output was consumed at steel plants.

Although crushed sandstone used in making refractory brick continued to be an important part of the mineral industry of the State, the output dropped from 33,000 tons, valued at $107,000, in 1953 to 22,000 tons, valued at $66,000, in 1954. General Refractories Co. and Murray Refractories Co. were the operating companies.

All sand and gravel was produced by construction and maintenance crews of the Utah State Road Commission and private contractors engaged in highway projects for that agency.

Manganiferous ore was produced from the Hope Mountain mine by Tintic Standard Mining Co. and shipped to the Western Electro-Chemical Corp. at Henderson, Nev. In addition, 3,585 long dry tons of manganiferous ore, averaging 26.9 percent manganese, was shipped to the Butte, Mont., and Wenden, Ariz., Government Purchase Depots from 4 mining operations in the county in 1954. Fred Staats, who operated the Staats manganese mine, had the largest output of ore.

The tungsten output from the county in 1954, less than half that in 1953, was produced by Elmer Jenkins from the Charity mines and sold to H. M. & S. Milling Co.

Millard.—Tungsten was the important mineral commodity in Millard County in 1954. Five operations produced tungsten ore and concentrate valued at $85,793. The largest producer was the Treasure Mountain Mining Co.

The value of the sand and gravel output dropped from $87,114 in 1953 to $9,280 in 1954; most of the sand and gravel was produced for the Utah State Road Commission for constructing and maintaining county highways, as in 1953.

L. J. Price mined manganiferous ore from the Dyke mine and shipped it to the Butte, Mont., Government Purchase Depot.

Morgan.—Cement continued to be the principal mineral commodity produced in Morgan County in 1954. Ninety-three men were employed in the plant of the Union Portland Cement Division, Ideal Cement Co., for 365 days. The company also operated a limestone pit where 14 men were employed in quarrying operations and 3 men operated the crusher for 180 days.

Clays were the second-ranking mineral in terms of value, and miscellaneous clay was mined from an open pit by the Interstate Brick Co. Four men were engaged in mining for 300 days, and the crude material was shipped to the company brick plant at Salt Lake City.

A small quantity of paving gravel was produced by the Utah State Road Commission, and 13,000 tons of paving gravel was quarried and used by private contractors engaged in highway work for the commission.

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Piute.—Uranium ore from mines near Marysvale continued to be the most important mineral output in Piute County in 1954. Vanadium Corp. of America, the prime producer of uranium in the area continued development work on the Freedom claims and acquired the adjoining Bullion-Monarch property. Uranium-ore production from the area was sold to the AEC buying depot at Marysvale and shipped to the Vitro Chemical Co. mill at Salt Lake City for processing. Other mineral products from the county included small quantities of gold, silver, copper, lead, and sand and gravel. Copper ore (74 tons) containing 28 fine ounces of gold, 4,409 ounces of silver, 4,458 pounds of copper, and 5,276 pounds of lead was produced from the Deer Trail mine near Marysvale in the Mount Baldy district by Arundel Mining Co.

Rich.—Two new operators actively entered the phosphate-rock field in Rich County during 1954. The San Francisco Chemical Co. began mining operations in the Crawford Mountains and shipped all its mine-run ore to Leefe, Wyo., for processing; and J. R. Simplot Co. commenced mining activity in the Rex Peak area. The Pearl Phosphate Co. did not engage in mining operations, but a few thousand tons of phosphate rock was sold from stocks of processed material. Private contractors working on State roads produced 34,000 tons of paving gravel in conjunction with contracts let by the Utah State Road Commission.

Salt Lake.—Salt Lake County, with the West Mountain (Bingham) district, was one of the most important mining, milling, and smelting areas in the United States. The total value of mineral production in the county in 1954 ($172,655,000) declined 16 percent, compared with 1953 ($206,471,000); 72 percent of the value ($124,284,000) was for copper. Other metals produced in the county in 1954 (value of output in parentheses) included gold ($12,942,000), silver ($3,724,000), lead ($8,134,000), zinc ($4,428,000), tungsten ($167,000), and molybdenum (value cannot be disclosed). Compared with 1953, these values showed decreases in output of gold, silver, copper, and molybdenum and increases in output of lead, zinc, and tungsten.

TABLE 18.—Mine production of gold, silver, copper, lead, and zinc in West Mountain (Bingham) district, Salt Lake County, 1945–49 (average), 1950–54, and total 1865–1954, in terms of recoverable metals

Year	Number of mines	Material [1] (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Total value
1945–49 (average)	6	22,476,639	278,591	3,897,215	204,402	24,900	17,419	$101,076,060
1950	6	31,405,801	428,313	4,963,586	277,655	27,472	16,120	146,983,284
1951	4	30,863,391	407,196	4,923,249	270,183	29,120	18,286	166,208,080
1952	4	32,484,298	417,607	5,338,291	282,098	34,328	20,395	173,807,807
1953	4	30,298,666	450,882	5,027,419	268,511	29,311	19,669	186,659,499
1954	4	24,431,422	369,760	4,109,083	210,643	29,671	20,489	153,495,560
1865–1954	--------	[2]748,388,569	8,920,944	181,313,814	6,665,051	1,801,366	639,490	3,008,400,209

[1] Does not include tonnage of precipitates shipped.
[2] Figures estimated for certain years before 1901.

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Despite a decline in output owing to a reduced demand for copper during the early part of the year and work stoppages later, the Utah Copper mine continued to be by far the leading producer of gold, silver, and copper in Utah in 1954 and ranked first in copper output in the United States. According to the 1954 annual report of the Kennecott Copper Corp., 24,079,400 tons of ore was mined by the Utah Copper Division from the Utah Copper open pit, concentrated at the Magna and Arthur mills, then shipped to the Garfield copper smelter and copper-anode plant of the American Smelting & Refining Co. The product from the Garfield smelter and plant was transferred to the Kennecott Copper Corp. copper refinery at Garfield, where the finished products were copper, gold, and silver bars. The company reported that 211,533 tons of copper was produced from the ore, plus substantial quantities of gold, silver, and molybdenum.

Significant technologic changes were made at the Utah Copper Division during 1954 to improve mining and milling procedure. Mobile drilling units (introduced in December 1953) eliminated 65 miles of compressed-air lines in the pit and substantially increased drilling efficiency. Old pipe from the air lines was used in constructing new electric-transmission towers of improved design. Electric power shovels of greater capacity, speed, and mobility increased the efficiency of pit operations, because each shovel did twice the work of the old type. A new method of preventing freezing of ore and waste in railroad cars during the winter resulted in a material saving in time and operating costs. Improved methods and equipment reduced the cost of moving and re-laying railroad track in the pit. Modernized electrification systems at the Magna and Arthur mills were installed in 1954 to reduce the possibility of interrupting production. A construction program was under way at the refinery to permit the production of a greater variety of cast-copper shapes to meet the demand. Significant improvements were made in processing selenium so that a product of extremely high purity, demanded by electronics and defense industries, was obtained. On July 17, 1954, Kennecott Copper Corp. observed the 50th anniversary of the founding of its Utah Copper Division (the old Utah Copper Co.) by dedicating the new Kennecott Research Center, constructed at a cost of $1,250,000, on the University of Utah campus.

The United States & Lark group of the United States Smelting, Refining & Mining Co. ranked first in Utah in 1954 in the production of lead and zinc, second in copper and silver, and third in gold. In addition, it ranked third in lead and fourth in zinc output among the mines of the United States. The output of lead and zinc from the mine increased in 1954, compared with 1953, and production of copper, silver, and gold decreased. According to the company 1954 annual report, operations at the mine were satisfactory and continued on an alternate 5- and 6-day, 2-shift basis. Ore production was slightly less than in 1953, but the grade was somewhat better. The development of new ore paced ore extracted, and the search for new areas was reasonably successful. Except for experienced miners, the labor supply during the year was adequate. Intensive studies to improve operating efficiency and to reduce costs effected some gains, especially during the latter half of the year.

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In addition to the output from the Utah Copper and United States & Lark mines, gold, silver, copper, lead, and zinc were produced from four other mines (Silver King Western, Dwyer claim, National Tunnel, and Butterfield) in Salt Lake County in 1954. Two other operations, not counted as producing mines in 1954, shipped cleanup material; one shipped lead-zinc ore cleanings from areas near the United States Smelting, Refining & Mining Co. loading ramps, and another shipped cleanings from old tanks at the Kennecott Copper Corp. mill at Magna.

The tungsten output came from H. M. & S. Milling Co. and Salt Lake Tungsten Co., which re-treated old tailing. Tungsten ore and concentrate purchased from numerous producers in Utah and other States was upgraded to a marketable product, which was sold to the General Services Administration or to consumers.

Although Salt Lake County was the largest producer of nonmetals in the State, with a value of $4.1 million, the nonmetallic group furnished only 2 percent of the total value of all mineral production—a gain of $700,000 over 1953. Increased residential and industrial building provided the stimulus for the gain in output, and for the first time sand and gravel sold or used led the list of nonmetals in value, with an increased output of 24 percent over 1953. Of the 2.3 million tons (valued at $1.6 million) produced in 1954, 2 million tons was classed as commercial output on the local market and 300,000 tons was produced and used in constructing and maintaining public streets and highways.

Cement produced by the Portland Cement Co. of Utah was the second-ranking nonmetal, and 9 percent more was produced than in 1953. In addition to 67 men at the cement plant, the company also employed 13 men at its limestone quarry and crusher facilities.

Production and sales of salt ranked third in the nonmetallic group, and the value of the output in 1954 increased 32 percent over 1953. The Morton Salt Co. operated its Saltair plant for 280 days during the year, and 82 men harvested the solar-evaporated salt.

The only lime production in the county was quicklime produced at the Magna plant of Kennecott Copper Corp. for use as a reagent in milling copper ore. The crushed limestone was quarried from pits operated by the Utah Lime & Stone Co. in Tooele County. In addition to the production of limestone as a source of lime, the American Smelting & Refining Co. produced a large quantity of oolitic limesand which was used as a flux at the Garfield copper smelter.

The only clay mined in the county was miscellaneous clay produced by the Interstate Brick Co., which used it in manufacturing building brick and other structural clay products. M. A. Johnson reported the production of 1,800 cubic feet of rough, monumental granite.

Among other nonmetal-processing facilities in Salt Lake County receiving raw material from other counties or States were the Utco Products Co. expanded-perlite plant and the exfoliated-vermiculite facility of Vermiculite-Intermountain, Inc.

Vitro Uranium Co., a division of Vitro Corp. of America, operated its uranium-processing plant at Salt Lake City throughout the year. The company renewed its contract with the AEC for the production

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of uranium concentrates in May and arranged to expand the mill capacity 50 percent, to be completed in 1955.

The two petroleum refineries of the Salt Lake Refining Co. and the Utah Oil Refining Co. were operated during the year. The plants were the largest of the five operating refineries in the State and processed four-fifths of the petroleum refined in Utah.

San Juan.—San Juan County during 1954 was the most active area in Utah in uranium exploration and development. Two major centers were the Big Indian district, noted for the Mi Vida mine of Utex Exploration Co., and the White Canyon district, location of the Happy Jack mine (known in the early 1900's as the Blue Dike copper prospect), of the Bronson & Cooper Mining Co. The Mi Vida and Happy Jack mines were the county's major producers during the year.

Other areas of activity were Montezuma Creek, 15–20 miles south-southeast of Monticello; Blanding area on Comb Ridge, 10 miles southwest of Blanding; and Monument Valley, 25–30 miles southwest of Mexican Hat in the vicinity of Oljeto Creek and the Arizona-Utah border.

In the Big Indian district the major effort was in delineating ore bodies by drilling and gaining access to them. Twenty-five rotary-drill rigs were operated throughout the year. Some of the active organizations were Utex Exploration Co., Homestake Mining Co., Cal Uranium Co., Standard Uranium Co., Continental Uranium Co., North American Uranium Co., and National Lead Co.

At the Mi Vida mine Utex Exploration completed a large part of its development and began mining with trackless equipment and a modified room-and-pillar method. Homestake Mining Co. completed a 3,200-foot adit on its Little Beaver property and a 550-foot shaft on the La Sal property. Cal Uranium completed its 280-foot San Juan shaft in the spring and began underground development. A drilling discovery was reported by U & I Uranium, Inc.

In May the AEC set up a temporary buying depot at Moab to purchase ores from the Big Indian district and almost completed a permanent buying depot by year end.

In the White Canyon district exploration was conducted in the following areas: Frye Point, Happy Jack, Red Canyon, Deer Flats, and Hite. Ore production came primarily from development work at the Happy Jack mine, the Gizmo and other mines at Frye Point, and the Blue Lizard mine in Red Canyon.

The AEC established a buying depot at the Happy Jack mine, and at Hite the Vanadium Corp. of America completed salvage operations of its pilot mill.

At Monticello additions to the AEC uranium-processing mill were begun. The plant was operated by Galliger Co. for the commission.

In addition to uranium, small quantities of silver and copper were produced from a mine operated by the Big Indian Uranium Corp. in the Big Indian district.

Discovery by Shell Oil Co. of the Desert Creek field in the Paradox basin attracted the attention of the oil industry by proving productive capacity in a large and relatively untouched area.

Sanpete.—In 1954, as in 1953, the chief mineral production, in value of output, in Sanpete County was rock salt from the Royal

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Crystal Salt Co. mine at Axtell. The salt was shipped to markets in Arizona, Colorado, Idaho, Missouri, Nevada, Oregon, Utah, and Wyoming for use by feed dealers in preparing salt cake for cattle ranchers.

Cox Bros. produced 4,200 tons of crushed limestone used in refining sugar and 7,200 tons of sand and gravel.

Sevier.—The value of mineral production in Sevier County in 1954 dropped to $1.1 million, compared with $1.2 million in 1953. The output of coal declined, and the production of gypsum, salt, and sand and gravel increased. Nonmetals furnished 81 percent of the total value in 1954, compared with 70 percent in 1953.

Gypsum was the most important mineral commodity in value in Sevier County, and the county supplied the entire State output. United States Gypsum Co. and Western Gypsum Co. were the only producers, and all output came from properties near Sigurd. The crude gypsum was processed in plants at Sigurd for use in manufacturing Keene's cement, plaster, wallboard, and other building materials.

Western Clay & Metals Co. continued to be the only clay producer in the region and produced 2,800 tons of fuller's earth and 2,200 tons of bentonite from its properties near Redmond; 3 men worked 30 days at the mine and 2 men 300 days at the processing plant.

Poulson Bros. continued to operate its rock-salt mine near Redmond, and the output in 1954 rose to 1,800 tons (1,500 tons in 1953). Refined salt was shipped to feed dealers in Arizona, Colorado, Idaho, Nevada, Utah, and Wyoming and used in preparing cattle feed.

Whiting & Haymond were the largest gravel producers in the county, and all output was used in paving roads. Sales of sand and gravel also were reported by Elmo R. Herring and Redmond Sand & Gravel Co.

Summit.—The total value of mineral production in Summit County rose from $932,000 in 1953 to $1,567,000 in 1954 as a result of the increased output of lead and zinc. Most of the lead and zinc came from the United Park City mines, which were consolidated from the Old Silver King and Park Utah properties and operated in 1954 after being idle since mid-1952. The mines ranked fifth in the State in lead production and fourth in zinc in 1954. Gold, silver, and copper also were recovered from the ore. McFarland & Hullinger shipped silver

TABLE 19.—Mine production of gold, silver, copper, lead, and zinc in Park City region, Summit and Wasatch Counties, 1945–49 (average), 1950–54, and total 1870–1954, in terms of recoverable metals

Year	Number of mines	Material (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Total value
1945–49 (average)	10	394,718	17,272	1,232,353	487	9,906	9,189	$6,867,587
1950	12	209,640	24,125	952,632	417	7,538	7,425	6,023,922
1951	12	230,607	18,476	1,131,360	470	11,719	10,209	9,668,591
1952	12	198,804	13,827	861,563	456	7,494	7,746	6,469,147
1953	8	193,405	27,919	802,036	630	4,235	4,848	4,289,278
1954	4	201,761	27,900	826,270	601	5,432	6,650	5,003,674
Total, 1870–1954		[1]16,901,725	729,635	243,467,075	38,511	1,272,880	409,419	422,869,697

[1] Figures estimated for certain years before 1901.

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ore from the Ontario dump, and silver tailing was shipped from the Grasselli dump.

Construction materials (clays, sand and gravel, and stone) were the only nonmetals produced in Summit County in 1954. All sand and gravel production resulted from road contracts let by the county highway department, Utah State Road Commission, and Federal Bureau of Public Roads. Dimension sandstone was quarried by the Mountain Park Quarries, Inc., and used as rough-construction building stone; the Utah Fire Clay Co. operated its miscellaneous clay quarry near Henefer and shipped the raw clay to its brick plant at Salt Lake City.

Tooele.—Nonmetals retained a position of importance in total value of all minerals marketed in the county. The output was valued at $2.05 million in 1954, compared with $2.07 million in 1953, and furnished 48 and 47 percent, respectively, of the total value of mineral production.

Potash, produced at the Wendover plant of Bonneville, Ltd., continued to be the most important mineral produced in the county. Potassium-bearing brine of the Salduro Marsh area of Bonneville salt flats was the source of the potash, and the output declined slightly from 1953. Limestone output continued to rise and increased to 83,000 tons in 1954, compared with 75,000 tons in 1953. The bulk of the production came from the Utah Lime & Stone Co. quarry near Grantsville and was sold mainly for controlling pH, rock dusting coal mines, manufacturing cement, and fluxing at smelters. In addition, the company produced 4,500 tons of lime, most of which was sold for making silica brick, as a reagent at lead-zinc milling plants, and for water purification and softening. Crushed limestone (calcite and aragonite) was produced at the Delle plant of Utah Calcium Products Co., and the bulk of the output was shipped to poultry dealers in the Western States for chickenfeed and to building contractors for roofing chips. The county production of salt rose from 26,000 to 31,000 tons, owing mainly to increased sales by the Deseret Salt Co. at Garfield and Stansbury Salt Co., Inc., at Grantsville. The salt was used chiefly for processing uranium ore, softening water, refrigeration, and cattlefeed.

Clay production increased slightly over 1953 because of the output of miscellaneous clay by the Interstate Brick Co. and Utah Fire Clay Co. The county production of sand and gravel dropped to 26,000 tons from 37,000; it was mostly paving gravel quarried by private contractors working for the Utah State Road Commission. A small quantity of pumice was produced in 1954 for testing purposes from the Mower Bros. deposit near Faust by Harborlite Corp.

Metals, including gold, silver, copper, lead, zinc, manganese ore, and tungsten concentrate, supplied 52 percent of the total value of mineral production in the county in 1954. The output of each of these metals remained the same as in 1953, with only minor increases and decreases. Eleven mines were active and produced varying quantities of gold, silver, copper, lead, and zinc. The largest producers were Ophir (McFarland & Hullinger) and West Calumet (Calumet Mining Co.). International Smelting & Refining Co. shipped zinc and copper slag from the dump at Tooele; the zinc slag was treated in the com-

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pany zinc-fuming plant, and the copper slag was shipped to a copper smelter.

Manganese ore (or concentrate) was produced from the Black Rock mine worked by H. E. Ellerbeck and shipped to the Western Electro-Chemical Corp. at Henderson, Nev. In addition, 147 long dry tons of manganiferous ore, averaging 26.6 percent manganese, was shipped to the Butte, Mont., and Wenden, Ariz., Government Purchase Depots from the Black Rock and Kramer mines.

The value of tungsten output in the county almost doubled in 1954, compared with 1953. Production came from nine mining operations, all small producers. Star Dust Mines, Inc., was the only operation that produced more than 100 short-ton units of WO_3.

Uintah.—Oil production from the 5 fields in the county rose to 1.85 million barrels in 1954. Increases came from the Red Wash and Walker Hollow fields and the Brennan Bottom field, which was discovered during the year by Gulf Oil Corp. Ashley Valley field remained the largest producer, with production of 1 million barrels. The county also is noted for its deposits of gilsonite near Bonanza. A small quantity of sand and gravel was produced.

Utah.—Limestone was the most important mineral commodity produced in Utah County in 1954, and the bulk was used as a flux at the Columbia-Geneva steel plant of the United States Steel Corp. Significant quantities also were used in making refractory brick and concrete aggregate. The Lakeside Lime & Stone Co. reported limestone output used in making lime, rock dusting coal mines, and refining sugar.

Of the total clays produced in 1954, 30,000 tons (67 percent) was fire clay and 15,000 tons was miscellaneous clay. All the raw clay was shipped to brick plants in Salt Lake City. The principal producers were Western Fire Clay Co., Utah Fire Clay Co., and Interstate Brick Co. Output of sand and gravel for building and highway construction remained the same as in 1953. The Lakeside Lime & Stone Co. produced quicklime used in steel and ore concentration plants, as well as in manufacturing stucco and asphalt. In 1954 all pumice came from the Wm. H. Prince & Sons property at Cedar Fork; it was shipped to the company plant at Salt Lake City, where it was used as an aggregate in making lightweight concrete blocks.

The Tintic Standard Mining Co. was the largest producer of gold, silver, copper, and lead; and it was second to the Colorado Consolidated Mines Co. in output of zinc in Utah County in 1954. The Tintic Standard Mining Co. shipped gold-silver tailings from the Harold dump and lead and silver ore from the Iron Blossom and Tintic Standard mines. Colorado Consolidated Mines Co. had a substantial production of silver and lead and some gold, zinc, and copper from silver and lead ore from the Colorado Consolidated mine in the Tintic district in 1954. Among the other eight mines in the county producing these metals in 1954, the largest producers were Eureka Standard Consolidated Mining Co., Sioux Mines Co., and Yankee Consolidated Mining Co.

Wasatch.—The total value of mineral production in 1954 in Wasatch County was almost the same as in 1953: Gold, copper, and zinc decreased; and silver, lead, and sand and gravel increased slightly. No limestone was produced in 1954, compared with 59,000 tons in 1953.

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The New Park Mining Co., from its Mayflower-Galena mine in the Blue Ledge district, was the largest producer in the county in 1954. It ranked second in gold, fourth in silver, third in copper and lead, and second in zinc output in the State. The company shipped 86,495 tons of lead-zinc ore (containing 25,865 fine ounces of gold, 430,394 ounces of silver, 566 tons of copper, 3,671 tons of lead, and 5,135 tons of zinc) to the custom-flotation mill of the Combined Metals Reduction Co. at Bauer. The following item is from the New Park Mining Co. annual report for 1954:

> New Park, its affiliates, subsidiaries and friends in Utah and Wyoming have obtained controlling stock interest in Lucky Mc Uranium Corporation of Riverton, Wyoming. This appears to have one of the largest uranium ore reserves in the western United States. Presently there is underway an active campaign of drilling to outline these reserves and justify the application for a mill. Re-negotiation of our mill contract with Combined Metals Reduction Company resulted in increased revenue to New Park. The Mayflower fissure was opened on the 1755 level, substantially increasing ore reserves. New ore shoots have been developed on the Pearl fissure that will also add to ore reserves. Freight rates were reduced on ore shipments from the Mayflower Mine. Our Labor Agreement with United States Steel Workers CIO was extended to July 1, 1955, at the same wage scale. The cooperation of New Park employees has enabled us to maintain our high standard of industrial relationship. Sinking operations were resumed in the Mayflower shaft to provide greater depth for new operating levels. A new compressed-air plant was completed at the Mayflower Tunnel Portal to provide additional power for underground operations.

All sand and gravel produced in the county was from quarrying operations by private contractors engaged in highway projects supervised by the Utah State Road Commission.

Washington.—Except for small quantities of gold, silver, and copper recovered by Lelia & Musick from copper slag from the Apex smelter dump, the output of these metals in the county in 1954 came from copper ore mined by Emerald L. Cox from the Apex mine and shipped directly to the smelter.

Maintenance and construction crews of the county and State road departments were active in 1954, and 28,000 tons of paving gravel was quarried and used on highways. Road contracts let by the Utah State Road Commission resulted in the production of 10,000 tons of paving gravel. In addition, the Nisson Stone Co. reported the production of 500 tons of dimension sandstone used as rough-construction building stone.

Wayne.—In 1954, 2 tons of copper and 46 fine ounces of silver were recovered from 43 tons of copper ore mined by B. M. Cook & A. B. Jensen from the T. R. Lode No. 1 in Torrey district of Wayne County and shipped to the American Smelting & Refining Co. Garfield smelter.

Weber.—Both commercial and Government-and-contractor production of sand and gravel was reported in 1954, and total output jumped from 262,000 tons in 1953 to 358,000 tons in 1954. Of the total sales, 159,000 tons was sold for highway work conducted by the county and State road departments and the Federal Forest Service, and the remaining 199,000 tons was consumed locally. The Harrisville Brick Co. reported the production of 15,000 tons of miscellaneous clay for use at the company Odgen brick plant. The Tri-State Minerals Co. also operated its talc-grinding mill at Ogden for crude talc mined in Montana.

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The Mineral Industry of Vermont

By Alvin Kaufman [1] and C. Geraldine Cleary [2]

THE $20.5 MILLION VALUE of mineral production in Vermont in 1954 surpassed by $181,000 the previous record established in 1953. Eleven mineral commodities were produced in the State in 1954, the most important of which were, in order of decreasing value, stone, slate, asbestos, and copper.

Mineral production was reported from every county except Essex. The principal producing counties were Lamoille, Orange, Rutland, and Washington, which were responsible for 93 percent of the State's mineral value. Rutland County owed its predominant position in Vermont's mineral economy to the production of slate and stone, whereas Washington County was principally a producer of stone and sand and gravel. The mines of Lamoille and Orange Counties yielded, primarily, asbestos and copper, respectively.

Some of the production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Bureau of the Census totals when they are available and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

TABLE 1.—Mineral production in Vermont, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Copper (recoverable content of ores, etc.)	3,947	$2,265,578	4,352	$2,567,680
Gold (recoverable content of ores, etc.)—troy ounces	171	5,985	185	6,475
Pyrites—long tons	19,486	(2)	20,713	(2)
Sand and gravel	1,113,607	690,073	1,481,549	1,110,996
Silver (recoverable content of ores, etc.)—troy ounces	43,128	39,033	48,572	43,960
Stone	[3] 527,150	[3] 8,859,703	436,870	8,178,389
Talc	80,209	240,627	66,195	198,585
Undistributed: Asbestos, clays, lime, slate, and minerals whose values must be concealed for particular years (indicated in appropriate column by footnote reference 2) less limestone used in manufacture of lime (1954)		8,201,233		8,377,342
Total Vermont		20,302,000		20,483,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Value included with "Undistributed."
[3] Excludes limestone used for manufacturing lime.

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REVIEW BY MINERAL COMMODITIES

METALS

Copper.—Appalachian Sulphides, Inc., took over control of the Elizabeth mine near South Strafford on June 1, 1954, from the Vermont Copper Co., Inc. Operating personnel remained the same. This mine was the only source of copper in Vermont in that year. The new company assumed the Vermont Copper Co. contract with the General Services Administration for delivery of copper under the Defense Production Act of 1950, as amended. The original contract, effective March 19, 1954, provided for delivery of 12 million pounds[3] of copper at $0.3106 per pound delivered.

Both surface and underground mining was done in 1954, although one of the surface mines ceased activity as a result of ore exhaustion during the year. A second pit was in full operation. The Elizabeth mine yielded an average of approximately 25,000 tons of ore per month, of which 6,000 to 7,000 tons was from open-pit operations. Appalachian Sulphides, Inc., reported on the use of mucking machines for stope drawing in its underground operations. The primary advantages of this system were improved ore extraction, cheaper and faster stope preparation, and a dewatered stope muck.[4] Ore output was beneficiated at the mine, and concentrate was shipped to the Laurel Hill smelter of the Phelps Dodge Corp.

Gold and Silver.—Gold and silver continued to be recovered as byproducts of smelting copper concentrate obtained from the milling of copper ore. Gold production increased 8 percent, and output of silver rose 13 percent in 1954 compared with 1953.

TABLE 2.—Mine production of copper, gold, and silver, 1945–49 (average) and 1950–54, in terms of recoverable metal

Year	Copper (short tons)	Gold (fine ounces)	Silver (fine ounces)	Year	Copper (short tons)	Gold (fine ounces)	Silver (fine ounces)
1945–49 (average)	2,466	119	25,937	1952	3,774	162	45,361
1950	3,504	146	28,205	1953	3,947	171	43,128
1951	3,774	156	41,300	1954	4,352	185	48,572

NONMETALS

Asbestos.—Vermont remained the leading United States domestic supplier of asbestos fiber in 1954. The Ruberoid Co., Vermont Asbestos Mines Division, continued to operate its mill and quarry in Lowell, 14 miles north of Hyde Park, Lamoille County. Plant capacity was estimated at 125 tons per hour of raw ore yielding 50,000 tons of fiber per year. Operations during 1954 were confined to the northern slope of Belvidere Mountain at the 1,050-foot, 1,150-foot, and 1,300-foot levels. Mining was conducted in 100-foot benches at each of these points to obtain the desired blend of ore. Plant tailing was used to pave the haulage road to the plant and also was

[3] Quantity was later reduced to 4 million pounds.
[4] Miller, C. L., Vermont Copper Uses Mucking Machines for Stope Drawing: Min. Eng., November 1954, pp. 1072–1076.

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sold to the Vermont State Highway Commission. The waste material provides an excellent nonslip road surface.[5]

Clays.—Miscellaneous clay was mined in Vermont in 1954 in Bennington and Chittenden Counties by two companies. Output was utilized by the producers for manufacturing building brick.

Lime.—Hydrated and quicklime for chemical and industrial purposes were produced by Vermont Associated Lime Industries, Inc. This company operated plants in Addison and Chittenden Counties in 1954.

Pyrites.—Pyrrhotite concentrate, recovered as a byproduct of copper ore milling, was sold for use in producing sulfur dioxide gas. Output was from the Appalachian Sulphides, Inc., Elizabeth mine near South Strafford.

Sand and Gravel.—Production of sand and gravel in Vermont in 1954 increased 33 percent compared with the previous year. This increase in output was due principally to the more complete coverage obtained as a result of the cooperative canvass with the United States Bureau of the Census. The average value of this commodity rose from $0.62 per ton in 1953 to $0.75 per ton in 1954. Twenty-seven commercial producers reported to the Bureau of Mines in 1954 compared with 12 companies in 1953. Washington, Caledonia, and Chittenden were the largest of the 12 counties from which production was obtained. The Vermont State Highway Department and its contractors remained the largest producer in Vermont, supplying over 50 percent of the State total. Structural and paving sand and gravel comprised 89 percent of total output.

Slate.—Vermont in 1954 became the largest slate-producing area in the Nation, surpassing Pennsylvania by a substantial margin. Output of this commodity increased 21 percent during the year compared with 1953. Production was sold for granules (86 percent), flagging (6 percent), roofing (4 percent), structural and sanitary purposes (2 percent), and miscellaneous uses (2 percent). All of the 16 quarries active in 1954 were in Rutland County. The largest producer was Central Commercial Co.

Stone.—Stone quarrying continued to be the most important mineral industry in Vermont in 1954. Output of the 16 active quarries in the State was responsible for 40 percent of the total value of Vermont mineral production. Stone quarried during the year included crushed, broken, and dimension granite and marble and crushed and broken limestone. Production of stone declined 17 percent in tonnage and 8 percent in value in 1954 compared with 1953. The average value of all types and uses of stone in 1954 was $18.72 per ton; the average value in 1953 was $16.81 per ton. The $1.91 increment over 1953 was due in large measure to higher values for monumental marble and granite. Building marble declined substantially in value during the year. Vermont dimension granite was used in constructing the Newport, R. I., War Memorial. Substantial quantities of marble were produced for use in the interior of the Manufacturers Trust Co., New York City, and the Fontainebleau Hotel, Miami, Fla. Major stone producers were the Vermont Marble Co., Rutland County, and the Rock of Ages Co., Inc., Washington County. Rutland and Washington Counties were the primary stone-producing areas, with the

[5] Briggs, M. L., More Efficient Mining and Modern Plant Double Asbestos Production: Rock Products, July 1954, pp. 74–78.

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principal granite output in the latter area and most of the marble coming from Rutland County. Limestone production was obtained from Franklin, Rutland, Chittenden, and Addison Counties. During the year 6 limestone, 6 marble, and 4 granite quarries were active.

Talc.—Production of talc in Vermont declined 17 percent in 1954 compared with 1953. Four mines were active in Lamoille, Washington, Windham, and Windsor Counties. The largest producing company was Eastern Magnesia Talc, Inc., with operations in Lamoille and Washington Counties. Virtually all of the crude talc produced in the State was ground for use in roofing (22 percent), insecticides (20 percent), paper (19 percent), rubber (18 percent), and miscellaneous items (21 percent). A small quantity of the crude material was sawed.

REVIEW BY COUNTIES

Addison.—Lime, sand and gravel, and stone were produced in Addison County in 1954. Vermont Associated Lime Industries, Inc., operated a quarry and lime plant near New Haven Junction during the year. The quarry yielded limestone for concrete aggregate, roadstone, agricultural stone, and lime manufacture. The latter was burned in the two company shaft kilns and sold as hydrated lime for agricultural sprays, insecticides, building paper, and canning uses. Peter Cousino continued to operate a sand and gravel pit near Bristol. Most of the production from this mine was sold as unwashed and unscreened building and paving material.

Bennington.—W. H. Hinman, Inc., operated a sand and gravel bank and portable processing plant near Arlington during most of 1954. Output of this operation was used in bituminous concrete paving. The plant was dismantled and shipped to Maine in October 1954, upon completion of road-contracting work for the State of Vermont. Bennington Brick Co., Bennington, operated an open-pit mine which yielded a heavy blue clay used in manufacturing building brick until September, when the plant was damaged by a hurricane and shut down for the remainder of the year.

TABLE 3.—Value of mineral production in Vermont, 1953–54, by counties

County	1953	1954	Minerals produced in 1954, in order of value
Addison	$277,492	$93,750	Lime, stone, sand and gravel.
Bennington	123,211	(1)	Sand and gravel, clays.
Caledonia	(1)	(1)	Sand and gravel.
Chittenden	100,287	361,886	Sand and gravel, lime, stone, clays.
Essex	(1)	----	
Franklin	(1)	(1)	Stone, sand and gravel.
Grand Isle	57,157	50,639	Stone.
Lamoille	(1)	(1)	Asbestos, talc, sand and gravel.
Orange	(1)	(1)	Copper, stone, pyrites, silver, gold, sand and gravel.
Orleans	----	(1)	Sand and gravel.
Rutland	(1)	7,350,996	Slate, stone, sand and gravel.
Washington	(1)	(1)	Stone, sand and gravel, talc.
Windham	(1)	(1)	Sand and gravel, talc.
Windsor	(1)	67,497	Sand and gravel, talc, stone.
Undistributed	19,744,185	12,558,659	
Total	20,302,000	20,483,000	

[1] Value included with "Undistributed."

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Caledonia.—Paving sand and gravel was produced in Caledonia County in 1954 by Caledonia Sand & Gravel Co., St. Johnsbury; and A. Booska Sand & Gravel Co., Inc., Hinesburg. The Booska Co. began operations in April 1954.

Chittenden.—Lime, sand and gravel, stone, and clays were produced in Chittenden County in 1954. The Vermont Associated Lime Industries, Inc., operated a limestone quarry and lime plant at Winooski. Building and paving sand and gravel were produced in 1954 by W. C. Kirby, Hinesburg; Vermont Paving Co., Richmond; and The Cass Corp., Hinesburg. Building brick was produced by the Drury Brick Co., Inc., from clay mined near Essex Junction.

Franklin.—Crushed and broken limestone for use as riprap, blast-furnace flux, concrete aggregate, roadstone, railroad ballast, agricultural stone, chemicals, and terrazzo was produced by Swanton Lime Works, Inc., Swanton, from an open quarry. The only other stone quarry active in 1954 was the Vermont Marble Co. operation near St. Albans. This quarry produced sawed and cut marble for building interiors. The plant closed during the year, and it was not anticipated that it would reopen. Sand and gravel for building purposes and engine sand were produced by bucket loader by the S. H. Evanson Co. from an open-pit near Swanton.

Grand Isle.—The Vermont Marble Co. Isle La Mott quarry produced rough blocks, which were cut and sawed for building and monumental purposes.

Lamoille.—The Vermont Asbestos Mines Division of the Ruberoid Co. operated the Lowell mine and plant near Eden, 14 miles from Hyde Park, in 1954. This operation produced chrysotile asbestos from an open-pit mine. Output was processed in the company mill near the mine. Eastern Magnesia Talc Co., Inc., produced talc from an underground mine near Johnson. Although a small quantity of crude talc was sold directly to consumers, most was processed in the company grinding mill. Ground material was sold for asphalt filler, foundry facings, crayons, paints, roofing, rubber, textiles, toilet preparations, and miscellaneous purposes. Building sand and gravel was produced by Volney C. Farr from a pit near Morrisville. Paving sand and gravel, most of which was sold to the State of Vermont, was produced by Albert S. Nadeau near Johnson. The Nadeau Co. operated a fixed-preparation plant which crushed, screened, washed, and classified mine output.

Orange.—The major mineral industry in Orange County in 1954 continued to be production of copper from the Elizabeth mine, 2 miles south of South Strafford. Appalachian Sulphides, Inc., owners and operators of the mine, milled all ore at the company flotation plant. Copper and pyrrhotite concentrates were produced. The copper concentrate yielded gold and silver when smelted. The J. K. Pirie Estate operated a granite quarry near Williamstown for the production of monumental stone. Paving and road gravel was produced by Levi Lemieux and Alex Laperriere from a gravel pit near Williamstown from May to the end of December 1954. Output was sold to local organizations for road repairs.

Orleans.—Building gravel was produced by Harry W. Jipner, Orleans, in Orleans County in 1954.

Rutland.—Slate, stone, and sand and gravel were produced in Rutland County in 1954. In terms of value, slate was the most important

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mineral commodity. Central Commercial Co., the principal slate producer in the county, operated a quarry at Castleton. Production was crushed and ground for use in manufacturing roofing granules. Other large producers of slate active in 1954 were Rising & Nelson Slate Co., Inc., West Pawlet; Pedro Bros. Slate Co., Fair Haven; Vermont Structural Slate Co., Inc., Fair Haven and Poultney; Taran Bros., North Poultney; Fred H. Graves and Culvert Slate Co., Inc., both of Poultney; and Harvey Bush Slate Co., Fair Haven. Output from the quarries of these companies was principally roofing and flagging slates. A high-calcium limestone for blast-furance flux was produced from underground and open quarries by the Vermarco Lime Co., West Rutland. Marble, for building and monumental purposes, was produced by Vermont Marble Co. and Green Mountain Marble Corp. from quarries at West Rutland.

Vermont Marble Co. also operated a sand pit near Brandon. Sand from this pit was used as an abrasive in marble sawing. Clark & Haynes, East Poultney, and R. D. Barker, West Rutland, produced sand and gravel, principally for building and paving purposes. Most of the production of these companies was sold to the State of Vermont and to nearby towns and townships, for construction of asphalt and tar roads. R. D. Barker reported in 1954 that he had constructed a new crushing plant.

Washington.—The quarrying of granite and marble was by far the most important mineral industry in Washington County in 1954. The county ranked first among the stone-producing areas of the State in value of output. The Rock of Ages Corp. surface mines near Graniteville and Websterville were the largest producers of granite in the county. Output consisted of rubble and rough and dressed monumental stone. Charles A. Pillette, Adamant, and Wells-Lamson Quarry Co., Websterville, were the only other granite producers.

Marble was produced by Vermont Marble Co. near Roxbury. Output was sold for building interiors and monumental use. Paul Dutton (Northfield), Clarence J. LePage and Wilfred D. Lovie (both of Barre), and Alfred Adams (Montpelier) produced sand and gravel. Eastern Magnesia Talc Co., Inc., operated its underground talc mine near Waterbury in 1954. Production was ground, crushed, or sawed in the company plant.

Windham.—Sand and gravel for paving and miscellaneous purposes was produced in Windham County in 1954 by Louise Allen, Bellows Falls; Brattleboro Sand & Gravel Co., Vernon; and Wardsboro Sand & Gravel Co., West Dover. Talc was produced from an underground mine by the Vermont Talc Co., Windham; this company used most of its production for grinding purposes near Chester Depot, Windsor County.

Windsor.—Sand and gravel, talc, and stone were produced in Windsor County in 1954. Paving sand and gravel output was reported by Colonial Sand & Gravel, Inc., from a river bank near Sharon. Talc for roofing filler was mined by Vermont Mineral Products, Inc., Reading, from an open-pit mine. Vermont Talc Co. operated its Chester grinding plant in the county in 1954. Output from this plant was sold primarily for insecticides, insulated wire and cable, rubber, paper, and miscellaneous uses. Marble was produced by Vermont Marble Co.

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The Mineral Industry of Virginia

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior and the Virginia Geological Survey.

By Robert W. Metcalf [1]

THE VALUE of mineral production in Virginia in 1954 decreased 15 percent compared with 1953. Substantial increases in value of the output of cement, lead, manganese, sand and gravel, and stone were thus more than offset by a decline in the value of coal production. Among minerals produced in Virginia in 1954 the most important, as measured by the value of products, were stone, cement, sand and gravel, lime, zinc, salt, manganese, lead, and gypsum. Coal was by far the chief mineral produced in both quantity and value. Virginia mineral resources were described in a summary report, giving brief accounts of the important minerals produced and their importance to the State economy.[2]

TABLE 1.—Mineral production in Virginia, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Beryllium concentrate			(2)	$39
Clays	952,266	$927,571	704,843	723,292
Coal	19,119,050	102,022,118	16,387,292	72,901,277
Lead (recoverable content of ores, etc.)	2,788	730,456	4,320	1,183,680
Lime (open-market)	477,384	4,947,418	445,158	4,610,645
Manganese ore (35 percent or more Mn) gross weight	8,454	635,926	22,678	1,780,934
Marl (calcareous)	(3)	(3)	33,174	21,079
Natural gas, million cubic feet	3,697	954,000	1,401	380,000
Petroleum (crude), 42-gallon barrels	8,000	(3)	7,000	(3)
Sand and gravel	5,276,350	5,160,564	7,115,403	8,657,871
Silver (recoverable content of ores, etc.), troy ounces	1,169	1,058	1,773	1,605
Slate	(3)	(3)	17,410	468,911
Stone	[4] 9,091,907	[4] 16,258,620	[5] 10,893,972	[5] 18,137,501
Zinc (recoverable content of ores, etc.)	16,676	3,835,480	16,738	3,615,408
Undistributed: Aplite, cement, feldspar, gypsum, iron ore (usable), kyanite, iron-oxide pigments (1954), mica, pyrites, salt, ground sand and sandstone, 1953, talc and soapstone, titanium concentrate, and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote 3).				
Excludes value of clays used for cement in 1953		17,505,609		19,403,489
Total Virginia		152,979,000		[6] 129,603,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Less than 1 ton.
[3] Included with "Undistributed."
[4] Excludes limestone for cement and lime.
[5] Final figure. Supersedes preliminary figure given in commodity chapter.
[6] The total has been adjusted to eliminate duplication in the value of clays and stone.

[1] Commodity-industry analyst, Region V, Bureau of Mines, Pittsburgh, Pa.
[2] Fisher, C. C., A Summary of Virginia's Mineral Resources: Virginia Minerals (pub. by Div. of Geol. Dept. of Conservation and Development, Charlottesville, Va.), vol. 1, No. 1, pp. 1–4.

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Some production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Bureau of the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953, because of differences in coverage.

Fuels output in 1954 comprised about 60 percent of the total value of mineral output in the State. Nonmetallics totaled over one-third of the total value, and metals accounted for the balance.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Virginia in 1954 produced 16.4 million short tons of coal and ranked sixth in order of production among coal-producing States; this was a 14-percent drop from 1953. The State possesses extensive reserves, and output ranged from semianthracite through low- and high-volatile coals and consisted of coals suitable for many purposes, including coking, steam, metallurgical, and domestic uses.

The semianthracite was mined in Montgomery County, while most of the bituminous coal was obtained from only four counties in the southwestern part of the State—Buchanan, Wise, Dickenson, Tazewell. Bituminous coal was produced largely from underground mines, although a substantial tonnage was obtained by stripping, including several auger mines.

Petroleum and Natural Gas.—Virginia was a relatively minor producer of petroleum and natural gas in 1954. The output of the latter commodity decreased sharply, compared with the previous year. Petroleum production declined 13 percent. Natural gas was obtained from the Early Grove field in Scott County and the Slate Creek and Keen Mountain fields in Buchanan County, the Nora field in Dickenson County, and scattered wells in Wise County. A history of oil and gas exploration and data on producing oil and gas wells in Virginia, including a list of successful gas wells in Dickenson and Buchanan Counties from 1948 through 1954, was presented by the Department of Conservation and Development of the Commonwealth of Virginia.[3] The Rose Hill field in Lee County yielded petroleum. A description of this field, occurring in the highly complex Appalachian geological structure, was published.[4]

METALS

Beryllium Concentrate.—Output of beryllium concentrate (beryl) in 1954 in Virginia was reported from Powhatan County by Piedmont Mining Co., Inc. This material was sold to the General Services Administration.

Iron Ore.—The only producer of iron ore in 1954 was American Pigment Corp., which mined residual lump ore from its property near Hiwassee, Pulaski County. The output was utilized for paint pigments.

[3] Harnsberger, W. T., Virginia's Oil and Gas Resources: Virginia Minerals (pub. by Div. of Geol., Dept. of Conservation and Development, Charlottesville, Va.), vol. 1, No. 2, January 1955, pp. 1–4.

[4] Miller, Ralph L., Rose Hill Field—Unique Oil Occurrence: Oil and Gas Jour., vol. 53, No. 13, Aug. 2, 1954, pp. 138–139.

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Lead and Zinc.—The output of lead in Virginia in 1954 rose to 4,320 short tons of recoverable metal, the highest since 1948 and nearly 55 percent greater than in 1953. The production of zinc continued high, increasing slightly to the largest quantity since 1947. The output of crude ore was expanded during the year to utilize the facilities of an enlarged and modernized concentrating mill. Ore from the Austinville mine of the New Jersey Zinc Co., in Wythe County, was treated at the company 2,000-ton-per-day mill at the mine. Zinc concentrate was shipped to smelters at Palmerton, Pa., and Depue, Ill. Dewatering of the Arminius mine purchased by the New Jersey Zinc Co. in the latter part of 1953 at Mineral, Louisa County, was begun after mine-water treatment facilities were devised and installed. Mine development at Austinville was completed and production begun at a new ore body, and development was begun in another new ore-body section. Good progress was made from the Austinville end in driving the 13,000-foot tunnel to connect with the new Ivanhoe mine. The Ivanhoe mine shaft was completed in 1953 and the surface plant in 1954. Work was begun in 1954 from the Ivanhoe end on the connecting tunnel to Austinville. Upon completion of the tunnel the zinc-lead ore from both mines will be treated at the Austinville mill.

TABLE 2.—Mine production of recoverable lead and zinc, 1945–49 (average) and 1950–54

Year	Lead		Zinc	
	Short tons	Value	Short tons	Value
1945–49 (average)	4,089	$1,102,140	15,763	$3,874,909
1950	3,254	878,580	12,396	3,520,464
1951	1,508	521,768	7,332	2,668,848
1952	3,792	1,221,024	13,409	4,451,788
1953	2,788	730,456	16,676	3,835,480
1954	4,320	1,183,680	16,738	3,615,408

Manganese.—Although Virginia still ranked third among the States in production of manganese ore containing 35 percent or more manganese in 1954, the output rose 168 percent compared with 1953 and totaled 22,678 short tons. This large increase resulted from a more active stockpiling program and the continuing demand for steel. Output was obtained from residual deposits derived from manganiferous sediments. Productive areas underlie remnants of dissected erosion surfaces or occur in synclinal basins and consist of nodules in residual clay or replacement of underlying limestones. All of the 1954 output consisted of metallurgical-grade material sold primarily to the General Services Administration for stockpiling. The principal active producers in 1954 were Flat Top Mining Corp. and Southern Manganese Corp., Bland County; Old Dominion Manganese Co., Frederick County; Manganese Mining & Contracting Corp., Glade Mountain Co., Sugar Grove Manganese Corp., Union Manganese Co., and Union Manganese Mining Corp., Smyth County; and Colitz Mining Co., Washington County.

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TABLE 3.—Manganese and manganiferous ores shipped from mines, 1945–49 (average) and 1950–54, in short tons

Year	Metallurgical manganese ore	Ferruginous manganese ore	Total	Year	Metallurgical manganese ore	Ferruginous manganese ore	Total
1945–49 (average)	2,099	2,086	4,185	1952	1,011	----	1,011
1950	56	----	56	1953	8,454	----	8,454
1951	----	----	----	1954	22,678	----	22,678

Silver.—Silver was recovered as a byproduct in beneficiating the zinc-lead ore mined at Austinville, Wythe County, by the New Jersey Zinc Co.

Titanium.—American Cyanamid Co. produced ilmenite in Nelson County in 1954 from a dike of nelsonite on the Warwick farm near Piney River. Although the ore body lies predominantly in Nelson County, there is a substantial tonnage in adjoining counties to the northeast and southwest.

NONMETALS

Cement.—A substantial output of both portland and natural cement was reported in Virginia in 1954. Shipments increased about 12 percent compared with 1953. Riverton Lime & Stone Co., Inc., produced natural cement in its six-pot-kiln plant at Riverton, Warren County. Local shale was used as raw material. Portland cement was produced at plants of the Lone Star Cement Corp., South Norfolk, Norfolk County, and Cloverdale, Botetourt County; and Lehigh Portland Cement Co., Fordwick, Augusta County. The South Norfolk plant of Lone Star Cement Corp. utilized marl as raw material; the other plants used limestone.

Clays.—Virginia output of clays decreased 26 percent in 1954 compared with the previous year, owing largely to a smaller tonnage of clays reported for use in manufacturing cement. Production consisted of miscellaneous clay for use in manufacturing brick, tile, and cement. The only producer of kaolin in the State, Cold Spring Mining Division, Yarra Engineering Corp., Greenville, Augusta County, discontinued operation. Major clay-producing companies during the year were United Brick Corp., Woodbridge Station, Albemarle County; Woodbridge Clay Products Co., Woodbridge, Prince William County; Roanoke-Webster Brick Co., Inc., Roanoke, Botetourt County; and Redford Brick Co., Richmond, Henrico County. Albemarle, Chesterfield, Henrico, and Prince William Counties reported the larger output of clays.

TABLE 4.—Clays (except for cement) sold or used by producers, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	406,248	$380,699	1952	940,496	$996,351
1950	681,381	621,189	1953	952,266	927,571
1951	775,245	825,097	1954	704,843	723,292

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Feldspar.—Feldspar was produced in Virginia in Bedford County in 1954. The only producer was the Clinchfield Sand & Feldspar Corp., operators of the Coles and Creswell mines. The Coles and Creswell mines produced potash feldspar. Virginia feldspar was utilized by the ceramic industries. The Commonwealth was the only State in the Nation to report production of aplite. Dominion Minerals Division, Riverton Lime & Stone Co., Inc., and Consolidated Feldspar Dept., International Minerals & Chemical Corp. (formerly Carolina Minerals Co., Inc.), operated mines near Piney River in Amherst and Nelson Counties, respectively, for the production of this commodity. Crude aplite was ground and sold as a low-cost source of alumina for glass manufacture.

Gypsum.—The only producer of gypsum in Virginia in 1954 was United States Gypsum Co., which operated a mine, mill, and plasterboard plant at Plasterco, Washington County. The company also operated a calcining plant at Norfolk for preparing domestic and imported gypsum.

Iron Oxide Pigments.—Active producers of iron oxide pigments in 1954 were American Pigment Corp., operators of mines at Hiwassee and Pulaski in Pulaski County; and Blue Ridge Talc Co., Inc., Franklin County. Production of these two companies consisted of mineral blacks and browns and red and yellow oxides, as well as ochers, siennas, and burnt and unburnt umbers.

Kyanite.—Virginia kyanite production was primarily from the Wissahickon formation, in which the kyanite occurs as bluish, long-bladed crystals, embedded in a biotite-feldspar schist. The only producer in 1954 was Kyanite Mining Corp., which operated a mine on Baker Mountain near Darlington Heights, Prince Edward County.

Lime.—Virginia continued in 1954 to be one of the more important producers of chemical lime in the United States, as over 94 percent of the State total output consisted of this type of lime. Production in 1954 was 7 percent less than the high level reached in 1953. The State has an abundance of high-quality limestone deposits suitable for manufacturing lime in the Shenandoah Valley and other valleys in the counties west of the Blue Ridge. Lime was also produced from Coastal Plain soft limestones, which consist mostly of shell marl. One plant in Norfolk County used oystershell as a raw material. Twelve plants were active in 1954. Major producers were National Gypsum Co. and Standard Lime & Stone Co., both of Kimballton, Giles County; M. J. Grove Lime Co., Frederick County; and Dominion

TABLE 5.—Lime (quick and hydrated) sold by producers, 1945–49 (average) and 1950–54, by types

Year	Agricultural		Building		Chemical and other industrial		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	21,139	$207,152	13,986	$142,083	223,379	$1,815,798	258,504	$2,165,033
1950	21,878	273,411	7,258	86,125	399,203	3,502,396	428,339	3,861,932
1951	22,840	285,443	6,309	81,005	423,531	4,185,208	452,680	4,551,656
1952	20,151	241,139	11,566	126,428	411,128	4,081,357	442,845	4,448,924
1953	19,215	243,030	10,819	117,477	447,350	4,586,911	477,384	4,947,418
1954	11,146	91,616	14,781	180,802	419,231	4,338,227	445,158	4,610,645

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Limestone, Inc., and Strasburg Lime Co., Inc., the latter two both in Shenandoah County.

Marl, Calcareous.—In 1954 Virginia was one of the leading producers of calcareous marl in the country. Virtually all of the output was utilized for agricultural purposes. Production centered in Clarke and Surry Counties. The output in Clarke County consisted of a travertine marl, while Surry County producers dredged their material from local areas in the Coastal Plain. Active producers were: Aimee Strother & Bro., Clarke County; J. C. Digges & Sons, White Post, Clarke County (operators of the Old Chapel Marl Plant); and Paul Miller, Spring Grove, Surry County.

Mica.—Producers of mica in Virginia in 1954 were Piedmont Mining Co., Inc., Powhatan, and J. E. Wilson, Bakersville, N. C., which reported small amounts of full-trimmed mica from Baltzley 1, 2, and 3 mines and the Johnny Young mine, in Powhatan County.

Perlite.—Virginia Perlite Corp., Hopewell, Prince George County, produced expanded perlite from crude material from southwestern United States. The output was sold to local building-supply dealers as an aggregate for plaster and concrete.

Pyrites.—Virginia ranked as a leading pyrites-producing State in 1954. General Chemical Division, Allied Chemical & Dye Corp., the only producer, operated its Gossan mine in Carroll County and produced lump and fine pyrites for use at the company sulfuric acid plant in Pulaski.

Salt.—Artificial brines from underground rock-salt beds were utilized in manufacturing chlorine caustic soda, liquid carbon dioxide, and "dry ice" by Mathieson Chemical Corp. at Saltville, Smyth County. This organization was the sole producer of salt in Virginia in 1954.

Sand and Gravel.—The output of sand and gravel in 1954 increased 35 percent compared with 1953, and the value increased 68 percent. This large production was due both to an augmented road-building program which consumed larger quantities of paving sand and particularly paving gravel and to much wider coverage of producing firms as a result of a joint Census of the Mineral Industries in 1954 with the United States Department of Commerce, Bureau of Census.

Although Virginia's 41 sand and gravel producers reported output of virtually every type of sand and gravel, 93 percent of the State production was utilized for building and paving material. Glass sand was produced by the Virginia Glass Sand Corp. in Frederick County near Gore.

The sand and gravel industry was concentrated on the Coastal Plain. The major producing counties, in order of decreasing output, were Chesterfield, Fairfax, Henrico, Prince George, Rockbridge, Princess Anne, and Smyth. The principal producers were Southern Materials Co., Inc., operating a pit in Chesterfield County; Commonwealth Sand & Gravel Corp. and West Bros., Henrico County; and Northern Virginia Construction Co., Inc., Modern Sand & Gravel Corp., and Virginia Sand & Gravel Co., Inc., all in Fairfax County.

Slate.—Virginia slates are not suited for millstock and consequently were utilized for roofing, roofing granules, flagging, and lightweight aggregate. The output in 1954 was somewhat less than in 1953.

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TABLE 6.—Sand and gravel sold or used by producers, 1953–54, by classes of operations and uses

	1953			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand:						
Building	943,661	$828,068	$0.88	834,517	$917,268	$1.10
Paving	914,104	493,615	.54	1,970,389	1,623,089	.82
Other	79,129	94,826	1.20	168,887	125,133	.74
Gravel:						
Building	1,490,271	1,718,954	1.15	893,014	1,459,936	1.64
Paving	1,259,916	1,537,286	1.22	2,575,242	3,765,490	1.46
Other				87,895	33,180	.38
Undistributed [1]	234,037	274,377	1.17	271,510	580,738	2.14
Total commercial sand and gravel operations	4,921,118	4,947,126	1.01	6,801,454	8,504,834	1.25
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand: Paving	68,981	45,534	.66	89,795	24,591	.27
Gravel: Paving	286,251	167,904	.59	224,154	128,446	.57
Total Government-and-contractor sand and gravel	355,232	213,438	.60	313,949	153,037	.49
Grand total	5,276,350	5,160,564	.98	7,115,403	8,657,871	1.22

[1] Includes glass, molding, grinding and polishing, fire or furnace, and engine sands and railroad-ballast gravel to avoid disclosing individual company operations.

Soapstone.—Virginia soapstone deposits are in Franklin and Nelson Counties. The State was one of the major sources of ground soapstone in the United States. The output was utilized for foundry facings, insecticides, roofing, and rubber manufacture. Producers active during the year were Alberene Stone Corp. of Virginia, Schuyler, Nelson County, and Blue Ridge Talc Co., Inc., Henry, Franklin County.

Stone.—The output of stone in Virginia increased 20 percent in 1954, compared with the previous year. Figures published for 1953 and 1954, however, are not directly comparable, as the 1953 data exclude stone used in manufacturing cement and lime. Concrete aggregate and road metal represented 52 percent of the State total output.

Virginia quarries yield virtually every type of stone. Rock types produced included limestone, granite, diabase, quartzite, dimension soapstone, greenstone, and marble. Limestone and dolomite, which comprised 74 percent of the total tonnage in 1954, were utilized predominantly for concrete aggregate, road metal, agricultural purposes, and fluxes. These carbonate rocks were quarried by 46 active producers in 22 counties. Granite was recovered by 4 producers active in 4 counties, chiefly in the Piedmont region. Diabase, which is classified by the Federal Bureau of Mines as basalt, is found mostly in the Triassic basins of the Piedmont and was produced by five operators. Quarrying of quartzite was concentrated on the north-

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TABLE 7.—Stone sold or used by producers, 1953–54, by kinds and uses

Kind and use	1953		1954	
	Short tons	Value	Short tons	Values
Dimension stone:				
Limestone, all uses			1,700	$3,650
Sandstone	3,600	$36,900		
Crushed and broken stone, granite:				
Riprap	1,000	1,500		
Concrete and road metal	1,276,159	1,882,450	1,519,989	2,083,528
Railroad ballast	253,077	303,409		
Other uses	47,082	43,339		
Basalt and related rocks: Concrete and road metal	590,437	962,669	599,464	842,091
Limestone:				
Riprap	72,941	136,319	698	698
Fluxing stone	429,108	660,190	483,806	773,150
Concrete and road metal	3,753,294	4,844,350	3,768,762	5,000,257
Railroad ballast	501,493	557,731	356,748	365,412
Agriculture	808,147	1,388,442	773,776	1,468,803
Miscellaneous	[1] 1,150,923	[1] 2,474,150	3,195,260	4,696,813
Sandstone, all uses	185,939	443,230	[2]	[2]
Miscellaneous stone: Concrete, road metal, and riprap			44,346	92,885
Undistributed [3]	18,707	2,523,941	149,423	2,810,214
Total	9,091,907	16,258,620	[4] 10,893,972	[4] 18,137,501

[1] Excludes stone used in the manufacture of lime and cement.
[2] Included with "Undistributed."
[3] Includes miscellaneous dimension stone, crushed and broken marble, and crushed sandstone.
[4] Final figure. Supersedes preliminary figure given in commodity chapter.

western slope of the Blue Ridge Mountains. The output was utilized principally for ferrosilicon. Three companies operating in three counties quarried dimension soapstone and greenstone. Marble, largely for terrazzo, was produced near Harrisonburg, Rockingham County.

REVIEW BY COUNTIES

Accomack.—Mineral output in Accomack County was confined to building and paving sand and gravel produced by the Eastern Shore Sand & Gravel Co., Inc., Mappsville, from its pit near Hallwood.

Albemarle.—Mines and quarries of Albemarle County in 1954 yielded stone, slate, and clay. The one source of slate was Blue Ridge Slate Corp., Charlottesville, which produced roofing granules at its plant near Esmont. Charlottesville Stone Corp., Charlottesville, and Superior Stone Co., Red Hill, operated quarries for producing greenstone and granite, respectively. These were utilized for concrete aggregate, road metal, railroad ballast, and stone sand. United Brick Corp. mined clay from its open pit near Woodbridge Station. Virginia Department of Highways reported production of paving sand for its own use in Albemarle County.

Amherst.—Aplite for use in glass manufacture was produced by Consolidated Feldspar Dept., International Minerals & Chemical Corp., Piney River. W. K. Smiley & Son operated a building-sand pit near Lynchburg.

Appomattox.—The only mineral commodity produced in Appomattox County in 1954 was limestone for concrete aggregate, road metal, and agricultural purposes. Active producers included Appomattox Stone Corp., and the State of Virginia.

Augusta.—Augusta Stone Corp. and Belmont Trap Rock Co., Inc., both of Staunton, and the Virginia Department of Highways pro-

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TABLE 8.—Value of mineral production in Virginia, 1953–54, by counties [1] [2]

County	1953	1954	Minerals produced in 1954 in order of value
Accomack	----------	(3)	Sand and gravel.
Albemarle	$911,566	$841,911	Stone, clays, slate.
Amherst	(3)	(3)	Aplite, sand and gravel.
Appomattox	(3)	153,414	Stone.
Augusta	(3)	(3)	Cement, stone, sand and gravel, clays.
Bedford	(3)	(3)	Feldspar.
Bland	440,003	(3)	Manganese.
Botetourt	6,971,273	8,495,333	Cement, stone, clays, lime.
Buchanan	29,841,371	22,569,222	Coal.
Buckingham	700,628	425,443	Slate.
Campbell	(3)	(3)	Stone, sand and gravel.
Caroline	(3)	(3)	Sand and gravel.
Carroll	(3)	(3)	Pyrites, stone.
Charlotte	64,191	----------	
Chesterfield	(3)	(3)	Sand and gravel, clays.
Clarke	(3)	20,629	Calcareous marl.
Craig	4,000	----------	
Culpeper	(3)	110,801	Stone.
Dickenson	22,689,708	13,602,308	Coal.
Dinwiddie	(3)	(3)	Sand and gravel.
Fairfax	1,305,776	1,951,420	Sand and gravel, stone.
Fauquier	442,529	418,029	Stone.
Franklin	(3)	(3)	Sand and gravel, soapstone.
Frederick	1,789,270	1,452,475	Stone, lime, sand and gravel, manganese, clays.
Giles	4,669,503	4,292,676	Lime, stone.
Goochland	520,000	350,000	Stone.
Greensville	(3)	(3)	Do.
Henrico	(3)	(3)	Sand and gravel, clays.
Henry	----------	(3)	Stone.
Isle of Wight	64,781	56,916	Lime, sand and gravel.
James City	----------	(3)	Sand and gravel.
King William	(3)	----------	
Lee	4,895,726	3,443,788	Coal, stone.
Loudoun	(3)	(3)	Stone.
Louisa	----------	38,000	Do.
Montgomery	1,004,563	209,759	Coal, stone, lime.
Nansemond	(3)	(3)	Clays, sand and gravel.
Nelson	(3)	(3)	Stone, titanium concentrate, soapstone.
Norfolk	(3)	(3)	Cement, sand and gravel.
Nottoway	205,000	(3)	Stone.
Orange	12,150	92,093	Do.
Pittsylvania	(3)	(3)	Do.
Powhatan	(3)	(3)	Mica, beryllium.
Prince Edward	(3)	(3)	Kyanite.
Prince George	(3)	623,152	Sand and gravel.
Princess Anne	(3)	330,929	Sand and gravel, clays.
Prince William	(3)	67,450	Clay.
Pulaski	(3)	501,435	Stone, iron oxide pigments.
Roanoke	451,431	519,418	Stone, clays, sand and gravel.
Rockbridge	798,121	997,748	Stone, sand and gravel, clays.
Rockingham	529,400	(3)	Stone, sand and gravel.
Russell	4,693,030	3,117,875	Coal.
Scott	198,032	(3)	Do.
Shenandoah	738,260	1,091,340	Lime, stone.
Smyth	2,046,794	4,574,186	Salt, stone, manganese, sand and gravel.
Spotsylvania	(3)	(3)	Sand and gravel.
Surry	(3)	(3)	Calcareous marl.
Tazewell	15,685,685	14,527,193	Coal, stone, lime, clays.
Warren	(3)	(3)	Cement, stone.
Washington	1,295,952	1,623,008	Gypsum, stone, manganese.
Wise	24,755,810	16,540,363	Coal, stone.
Wythe	4,911,846	5,166,767	Zinc, lead, stone, silver.
Undistributed	20,342,421	21,398,056	
Total	152,979,000	[4] 129,603,000	

[1] The following counties are not listed because no production was reported: Alleghany, Amelia, Arlington, Bath, Brunswick, Charles City, Cumberland, Elizabeth City, Essex, Floyd, Fluvanna, Gloucester, Grayson, Greene, Halifax, Hanover, Highland, King and Queen, King George, Lancaster, Lunenburg, Madison, Mathews, Mecklenburg, Middlesex, New Kent, Northampton, Northumberland, Page, Patrick, Rappahannock, Richmond, Southampton, Stafford, Sussex, Warwick, Westmoreland, and York.

[2] Value of fuels, including coal, for certain counties, petroleum, and natural gas included with "Undistributed."

[3] Value included with "Undistributed."

[4] Excludes value of clays and stone used in manufacturing lime and cement.

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duced substantial quantities of limestone, which was crushed for use as concrete aggregate, road metal, agricultural stone, and riprap in 1954. The Virginia Department of Highways also produced some dimension rough block and rubble. Agricultural stone was produced by the State. F. R. Weeks, Raphine, produced building sand. Miscellaneous clay and shales were mined by North Mountain Brick Co., Inc., near Staunton. Lehigh Portland Cement Co. operated a portland-cement plant near Fordwick. Virginia Department of Highways reported output of paving gravel for its own use.

Bedford.—Bedford County was the only feldspar-producing county in Virginia in 1954. Output was obtained from the Clinchfield Sand & Feldspar Corp. Coles mine near Bedford and the Creswell mine near Forest.

Bland.—Manganese was the only mineral produced in Bland County in 1954. Flat Top Mining Corp., Bland, and Southern Manganese Corp., Bastian, were the chief producers.

Botetourt.—Cement, lime, limestone, and clay were produced in Botetourt County in 1954. Lone Star Cement Corp. produced portland cement at Cloverdale. Roanoke-Webster Brick Co., Inc., the only producer of miscellaneous clay in Botetourt County, continued to work its pit near Roanoke. The output was used in making heavy clay products. A detailed description, using diagrams and illustrations of this integrated clay plant, which produces face brick, lightweight aggregate, and concrete brick, was published in 1954.[5]

Eagle Rock Lime Co., Eagle Rock, produced building lime at its kiln near Clifton Forge. This company, with Blue Ridge Stone Corp. (Blue Ridge), James River Hydrate & Supply Co. (Buchanan), and Liberty Limestone Corp., operators of Sherwood and Rocky Point Quarries, produced limestone for concrete aggregate, road metal, railroad ballast, agricultural purposes, flux, dust for coal mines, riprap, whiting, filler, and cement manufacture.

Buchanan.—In 1954 Buchanan County was 1 of the 4 leading coal producers in Virginia. A substantial quantity of natural gas was recovered from the Slate Creek and Keen Mountain gas fields.

Buckingham.—Slate was the only mineral commodity produced in Buckingham County in 1954. Blue Ridge Slate Corp., Charlottesville, operated a quarry near Dutch Gap and produced roofing granules. Other active producers in 1954 were: Arvonia-Buckingham Slate Co., Inc., and Williams Slate Co., both of Arvonia; and Le Sueur-Richmond Slate Corp., Ore Bank. The output of these quarries was utilized for roofing and flagging.

Campbell.—Rough and dressed building stone, as well as flagging, laboratory-table tops, and bakery hearths, was produced by Virginia Greenstone Co., Inc., from its greenstone quarry near Lynchburg in 1954. Virginia Department of Highways reported production of paving sand and gravel.

Caroline.—Building sand and gravel produced by Gwathmey Sand Co., Hanover, was the only mineral product of Caroline County in 1954.

Carroll.—Pyrites was produced from the Gossan mine in Carroll County in 1954 by the General Chemical Division, Allied Chemical &

[5] Brick and Clay Record, Roanoke-Webster Develops Highly Integrated Operation: Vol. 124, No. 5, pp. 35–38, 71.

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Dye Corp. The entire output of the mine was utilized at the Pulaski sulfuric acid plant of the parent corporation. Sandstone was quarried by the town of Galax for its own use.

Chesterfield.—A substantial tonnage of miscellaneous clay was mined by Southside Brick Works, Inc., Richmond. The only producer of sand and gravel, Southern Materials Co., Inc., Chester, sold its products for paving and roadwork.

Clarke.—Calcareous marl for agricultural purposes was mined at White Post by Aimee Strother & Bro. and J. C. Digges & Sons.

Culpeper.—Culpeper Stone Co., Culpeper, quarried stone for concrete aggregate and road metal. The Culpeper district of the State department of highways produced limestone for concrete and road metal.

Dickenson.—Dickenson County was one of the leading coal-producers in Virginia in 1954. The output included a substantial tonnage of strip coal. A small quantity of natural gas was obtained from the Nora gas field.

Dinwiddie.—Mineral production in Dinwiddie County in 1954 was limited to sand and gravel. Sand and gravel for highway purposes was mined by the Petersburg city engineer.

Fairfax.—Fairfax County ranked second among Virginia Counties in sand and gravel output in 1954. Producers were Northern Virginia Construction Co., Inc., Modern Sand & Gravel Corp., Virginia Sand & Gravel Co., Inc., Belvoir Sand & Gravel Corp., and William A. Clem Road Gravel Co., all with offices in Alexandria. These firms produced substantial quantities of sand and gravel for building purposes, except the last, which produced building gravel only. Fairfax Quarries, Inc., produced basalt for use as concrete aggregate and road metal. Virginia Department of Highways reported output of paving gravel for its own use.

Fauquier.—Concrete aggregate, road metal, rough building stone, and flagging were produced in Fauquier County in 1954 by Millbrook Quarries, Inc., Broad Run; and W. W. Sanders, Warrenton. The Sanders quarry was in basaltic rock. Millbrook Quarries produced limestone.

Franklin.—Blue Ridge Talc Co., Inc., produced soapstone in 1954 at its King-Ramsey mine near Henry. Output was ground for use as foundry facing and insecticide filler. This company also produced finished iron oxide pigments, including mineral blacks, natural browns and red oxides, and ochers. Virginia Department of Highways produced paving gravel.

Frederick.—Glass sand, burnt lime, clay, ground silica, limestone, and manganese were produced in Frederick County in 1954. Stuart M. Perry, Inc., Winchester, and M. J. Grove Lime Co., Stephens City and Middletown, operated limestone quarries. Their output was utilized for concrete aggregate, road metal, blast-furnace flux, and open-hearth, agricultural, and miscellaneous uses. The Stephens City underground quarry and Middletown open pit of M. J. Grove Lime Co. also yielded a substantial quantity of raw material for the company burnt-lime plant at Stephens City. Lime production was sold for building, agricultural, and chemical uses. Virginia Glass Sand Corp. continued to operate its open pit at Gore in 1954. Shenandoah Brick & Tile Corp. produced clay for manufacturing brick at its pit

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at Winchester. Old Dominion Manganese Co., Star Tannery, operated the Mineral Ridge mine during 1954.

Giles.—Giles County in 1954 ranked first among lime-producing counties in Virginia. Plants active during the year included National Gypsum Co. and Standard Lime & Stone Co., both at Kimballton, and Ripplemead Lime Co., Inc., Ripplemead. The output was utilized for building, agricultural, and chemical purposes and for rock dust. In addition to this commodity, the first two companies and Virginian Limestone Corp., Klotz, produced crushed limestone for concrete aggregate, road metal, railroad ballast, filler, and chemical uses by paper mills.

Goochland.—Boscobel Granite Co. worked its granite quarry at Manakin during 1954 and produced crushed material sold for concrete aggregate and road metal.

Greensville.—A substantial tonnage of concrete aggregate, road metal, and railroad ballast was produced by Trego Stone Corp., from a granite quarry at Skippers.

Henrico.—Building and paving sand and gravel were recovered by Commonwealth Sand & Gravel Corp. from pits near Richmond and by West Bros., Richmond. Redford Brick Co. and Daniels Brick & Tile Co., Inc., operated pits for producing clay near Richmond in 1954. Henrico County Highway Department reported producing paving sand and gravel for its own use.

Henry.—Mineral production in Henry County in 1954 was limited to granite from the city-owned Martinsville quarry.

Isle of Wight.—Battery Park Fish & Oyster Co., Smithfield, produced a substantial quantity of agricultural lime from limestone and oystershell. The Virginia Department of Highways reported output of paving sand for its own use.

James City.—D. C. Waltrip, Williamsburg, produced some paving gravel.

Lee.—The major mineral commodity produced in Lee County in 1954 was bituminous coal. The output came from the northwestern part of the county. A substantial quantity of high-gravity paraffin-base petroleum was obtained from the Rose Hill field, discovered in 1941. Kentucky-Virginia Stone Co., Gibson Station, operated a limestone quarry for the production of riprap, concrete aggregate, road metal, railroad ballast, agricultural stone, and rock dust.

Loudoun.—Arlington Stone Co. operated a basalt quarry near Leesburg for the production of concrete aggregate and road metal. This was the only mineral operation reported in the county.

Louisa.—Superior Stone Co., Raleigh, N. C., operated a limestone quarry during 1954 near Gordonsville. The product was used for concrete aggregate and road metal.

Montgomery.—Limestone, semianthracite, and burnt lime were produced in Montgomery County in 1954. The last commodity was produced by Montgomery Lime Co., Inc., Christiansburg, operators of an agricultural lime plant near Ellett. Although the output of coal was small, Montgomery was the only county in Virginia to produce semianthracite, which was sold locally in competition with Pennsylvania anthracite. Limestone for use as concrete aggregate and road metal was quarried by Albert Bros. Contractors, Salem;

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Montgomery Lime Co., Inc., Christiansburg; and the City of Radford. Dry Valley Lime Co. produced limestone for agricultural purposes.

Nansemond.—Roanoke-Webster Brick Co., Inc., operated a clay pit near Suffolk and used the clay in manufacturing heavy clay products. Virginia Department of Highways reported output of paving sand for its own use.

Nelson.—American Cyanamid Co. operated an ilmenite mine on the Warrick farm near Piney River in 1954. Aplite was mined by Dominion Minerals Division, Riverton Lime & Stone Co., Inc. A substantial tonnage of soapstone was recovered by Alberene Stone Corp. of Virginia from its mine near Schuyler. Part of this output was used as building stone and for laboratory equipment; the balance was ground for roofing and rubber filler.

Norfolk.—Lone Star Cement Corp. utilized marl as raw material to produce portland cement at its South Norfolk plant.[6] Norfolk & Western Railway and Virginian Railway Co. produced some engine sand.

Nottoway.—Granite for use as concrete aggregate and road metal was quarried near Burkeville by Burkeville Stone Corp.

Orange.—Output of concrete aggregate and road metal was reported by Royal Stone Corp., Madison Run, from a stone quarry at Madison Run in 1954.

Pittsylvania.—The city of Danville quarried granite for local use.

Powhatan.—Powhatan County was the only area from which output of mica was reported in Virginia in 1954. Full-trim sheet was produced at the Baltzley Nos. 1, 2, and 3 mines of the Piedmont Mining Co., Inc., in the Huguenot district and by J. C. Wilson, Baskersville, N. C., from the Johnny Young mine near Powhatan. Beryllium concentrate also was reported by Piedmont Mining Co., Inc.

Prince Edward.—Kyanite was mined on Baker Mountain near Darlington Heights and shipped from Cullen by Kyanite Mining Corp. Production was utilized for refractories and ceramics.

Prince George.—Virginia Perlite Corp., Hopewell, was the sole processor of expanded perlite in Virginia. Raw material for operating this plant was imported from southwestern United States. Arthur Hitch, Norfolk, and Friend Sand & Gravel Co., Inc., and Bryan Rock & Sand Co., Petersburg, produced building and paving sand and gravel.

Prince William.—A substantial quantity of shale for use in manufacturing brick and heavy clay products was produced in Prince William County in 1954 by Woodbridge Clay Products Co. at its pit at Woodbridge.

Princess Anne.—Little Creek Sand & Gravel Corp., E. V. Williams Co., Inc., J. C. Jones Sand Co., Inc., and Tidewater Sand Co., Inc., operated wet pits near Diamond Spring, Cape Henry, and Little Creek, respectively, to produce engine, fertilizer filler, building and paving sands. Miscellaneous clay was mined from a pit near Oceana by Eureka Brick Co., Inc.

Pulaski.—American Pigment Corp. produced iron ore from near Hiwassee. This material was pulverized and shipped as mineral

[6] Although South Norfolk is an independent city, for the purposes of this chapter, it will be included in Norfolk County.

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pigment, such as mineral blacks, natural brown, red and yellow oxides, ochers, siennas, and umbers. Concrete aggregate, road metal, and stone sand for building purposes were quarried by Radford Limestone Co., Inc., Radford.

Roanoke.—Limestone for use as concrete aggregate, road metal, and agricultural stone was produced by Rockydale Quarries Corp., Roanoke, in 1954. The Roanoke district of the Virginia Department of Highways used sizable tonnages of limestone for concrete aggregate and road metal. Building sand was produced by Marl & Stone Corp., Roanoke, near Salem. Norfolk & Western Railway produced sand. Salem Brick Co., Inc., Salem, was the only producer of clay.

Rockbridge.—Mathews-Curtis Co., Inc., produced a substantial quantity of quartzite at its quarry at Greenlee. The output was utilized in preparing ferrosilicon, as well as for concrete aggregate, road metal, plastering, and railroad ballast. Limestone for use as concrete aggregate, road metal, and railroad ballast was quarried by Charles W. Barger & Son, Lexington, and Lone Jack Limestone Co., Inc. Miscellaneous clay was produced by Locher Brick Co., Inc., Glasgow, for use in making building brick. Locher Silica Corp., Glasgow, produced glass and building sand at its pits in the Walker Creek district. Virginia Department of Highways reported producing paving gravel for its own use.

Rockingham.—Limestone was quarried and crushed in Rockingham County in 1954 by Fred K. Betts, III, R. Y. Frazer, and C. S. Mundy Quarries, Inc., of Harrisonburg. Output was utilized for concrete aggregate, road metal, agricultural stone, and railroad ballast. Jamison Black Marble Co., Roanoke, produced terrazzo. Paving gravel was produced for its own use by Virginia Department of Highways.

Russell.—Russell County mines in 1954 produced substantial tonnages of bituminous coal. Output was chiefly from the Clinchfield, Dante, Wilder, and St. Paul areas.

Scott.—The major mineral commodity produced in Scott County in 1954 was natural gas from the Early Grove field, a major source of natural gas in Virginia. A small quantity of bituminous coal was mined in Scott County during the year.

Shenandoah.—Concrete aggregate, road metal, flux, and agricultural limestone were produced by Strasburg Lime Co., Inc., and Dominion Limestone, Inc., Strasburg; Shenandoah Valley Lime & Stone Corp., Capon Road; Toms Brook Lime & Stone Co., Inc., Toms Brook; and C. S. Mundy Quarries, Inc., Forestville. The only two producers of lime in Shenandoah County in 1954 were Strasburg Lime Co., Inc., and Dominion Limestone, Inc., Strasburg.

Smyth.—Manganese Mining & Contracting Corp., Union Manganese Co., Union Manganese Mining Corp., and Glade Mountain Co., all near Marion, worked the Glade Mountain manganese mines in 1954. Ore produced assayed (natural) 35 percent or more manganese. H. & H. Contracting Corp. also mined some manganese ore. Mathieson Chemical Corp. produced artificial brines from rock salt near Saltville. The brines were used for manufacturing chlorine, caustic soda, liquid carbon dioxide, and dry ice. The Mathieson Chemical Corp. also produced a large tonnage of limestone for chemical use by alkali plants, as well as for concrete aggregate, and road

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metal. Limestone for the last two uses was produced by J. E. & L. S. Ellis and Holston River Quarry, Inc., both near Marion. Agricultural limestone was also produced and sold by J. E. & L. S. Ellis. A substantial quantity of building sand was produced in Smyth County in 1954 by Sayers Sand Co. and C. R. Snider & Sons Sand Co., both of Marion.

Spotsylvania.—Massaponax Sand & Gravel Corp. recovered a substantial quantity of paving sand and gravel during the year from its pit near Fredericksburg.

Surry.—The one mineral commodity produced in Surry County in 1954 was calcareous marl, mined from the Paul Miller pit at Spring Grove.

Tazewell.—Tazewell County is one of the leading coal-producing counties in Virginia. Production was derived mainly from Pocahontas, Boissevain, Sayresville, Jewell Ridge, and Red Ash seams. Crushed limestone for concrete aggregate, road metal, railroad ballast, coal-mine rock dust, and flux was produced by Pounding Mill Quarry Corp., Pounding Mill, and Peery Lime Co., North Tazewell. Burnt lime for agricultural and building purposes, as well as for chemical usage, was prepared by Blue Grass Lime Co., Tazewell, and Peery Lime Co., North Tazewell. General Shale Products Corp. mined a substantial tonnage of miscellaneous clay at its pit near Richlands for use in manufacturing building brick.

Warren.—Natural cement was produced by Riverton Lime & Stone Co., Inc., Riverton. The plant consisted of six pot kilns utilizing Buckwheat and Pea coal for fuel. This company also quarried a substantial tonnage of limestone for use as concrete aggregate, road metal, railroad ballast, and agricultural stone.

Washington.—Washington County was the only gypsum-producing area in Virginia in 1954. Output came from the United States Gypsum Co. mine near Plasterco. Colitz Mining Co. began to mine 35 percent or more grade of manganese ore in Washington County. The Virginia Department of Highways produced limestone and sandstone for its own use near Bristol. Lambert Bros., Inc., Bristol, quarried limestone near Bristol for concrete aggregate and road metal.

Wise.—Wise County produced substantial tonnages of bituminous coal in 1954. A small production of natural gas was reported from a few scattered wells in Wise County. Concrete aggregate, road metal, and agricultural limestone were produced near Big Stone Gap by Southwest Quarries, Big Stone Gap.

Wythe.—The Austinville mine of the Bertha Mineral Division, New Jersey Zinc Co., equipped with a 2,000-ton mill, continued to produce lead and zinc concentrates in 1954; some silver was recovered. This company also produced a substantial quantity of limestone for fertilizer filler and agricultural purposes. Pendleton Construction Corp., Wytheville, and the town of Wytheville quarried limestone for concrete aggregate and road metal.

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The Mineral Industry of Washington

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MINERALS produced in Washington in 1954 declined nearly 4 percent ($1,955,000) in value despite an increase of more than $4 million in the value of output of sand and gravel, nearly $3.5 million for stone, and smaller increases in the value of gold, peat, and tungsten. (The increase for sand and gravel was due almost entirely to expanded statistical coverage of this important industry. The increase for stone did not materially affect the State production total, since a revised method of presenting the data in table 1 shows the respective values of clay and limestone used in cement under each of these commodities as well as being included in the total value for cement; therefore, adjustment of the State total figure in table 1 is necessary to avoid duplication of values.) The decrease in total value of production was due in large part to a drop of about $2.7 million (36 percent) in the value of zinc produced because of depressed market conditions; other commodities showing a substantial reduction from 1953 were coal (11 percent), lead (6 percent), cement (2 percent), diatomite (10 percent), lime (21 percent), magnesite (62 percent), and quartz (53 percent).

Aluminum metal production, not included in the State mineral production total, continued to climb as the three producing companies in the State carried on expansion programs to meet increasing demand. Value of output from the State's 5 reduction plants rose from about $158 million in 1953 to more than $175 million. The General Petroleum Corp. Ferndale oil refinery was put in operation in November, and construction of the Shell Oil Co. refinery at Anacortes continued. Crude oil for these plants will come from Alberta, Canada, by pipeline and by tanker from overseas sources. The Pacific Northwest at last was assured a supply of natural gas with signing of an agreement that provided for bringing gas from fields in New Mexico, Colorado, and British Columbia. This development was expected to have a profound impact on the establishment of new industries and expansion

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TABLE 1.—Mineral production in Washington, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	259,421	$312,141	261,328	$318,500
Coal	689,831	5,047,928	619,209	4,478,127
Copper (recoverable content of ores, etc.)	3,740	2,146,760	3,626	2,145,240
Epsomite	200	8,000	(2)	(2)
Gold (recoverable content of ores, etc.)—troy ounces	62,560	2,189,600	66,740	2,335,900
Gypsum	3,800	14,250	(3)	(3)
Lead (recoverable content of ores, etc.)	11,064	2,898,768	9,938	2,723,012
Peat	32,107	104,274	43,134	153,058
Sand and gravel	11,182,835	9,317,793	16,044,687	13,595,014
Silver (recoverable content of ores, etc.)—troy ounces	321,202	290,704	313,735	283,946
Stone (except limestone for cement and lime)	4,438,259	5,890,849	5,366,890	9,526,534
Talc and soapstone	5,351	28,833	(2)	(2)
Tungsten concentrate—60-percent WO_3 basis	5	19,710	18	65,812
Zinc (recoverable content of ores, etc.)	32,786	7,540,780	22,304	4,817,664
Undistributed: Barite (1953), carbon dioxide, cement, diatomite, gem stones, grinding pebbles, lime, manganese ore (1953), magnesite, pumice and pumicite, quartz (1953), ground sand and sandstone (1953), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2). Excludes value of clays used for cement (1953)	----------	18,766,830	----------	16,923,833
Total Washington	----------	54,577,000	----------	[3] 53,300,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Value included with "Undistributed."
[3] Total has been adjusted to eliminate duplication in the value of clays and stone.

of present industries in the area. Transportation of mineral products by barge up the Columbia River from Portland, Oreg., to points as far east as Pasco, Wash., continued the increase begun in recent years. With completion of The Dalles Dam, under construction throughout the year by the Corps of Engineers on the Columbia River between Washington and Oregon, and other planned projects, even greater use of the river as an inland waterway may be expected.

Gypsum supplied from quarries on San Marcos Island, Mexico, was imported after completion of the Kaiser Gypsum Co., Inc., gypsum-products plant in Seattle. Other imported mineral materials included copper ore and concentrate, ammonium compounds, chromite ore, and peat moss for soil conditioning. Refined copper was the principal item in the list of exports, which also included portland cement, aluminum sheets and plates, structural iron and steel, and bituminous coal.

Crude materials received for processing from other States included copper concentrate and alumina. Lead and zinc concentrates, tungsten ore and concentrate, and refractory magnesia were among the products shipped to other States.

The mining industry in Washington employed about 2,300 workers. Of the total, nearly 900 were employed at metal mines, 700 in bituminous-coal mining, 300 at stone quarries, 300 at sand and gravel pits and dredges, and most of the remainder in producing clays for ceramics and refractories. There has been a considerable decrease in employment since 1947, when the number of workers totaled 3,400. A decrease in coal mining has been the main factor causing the decline.

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The present importance of mining in Washington in 1954 can be gaged by the fact that the industry paid $10.7 million in wages.

In mineral-manufacturing industries, smelting, refining, and casting expanded from an average of 9,000 employees in 1947 to 12,200 in 1954. The 1954 breakdown of this group shows that 49 percent of the workers were in smelting and refining of nonferrous metals; 25 percent in rolling, drawing, and alloying of nonferrous metals; 15 percent at blast furnaces, steelworks, and rolling mills; and the balance at foundries and miscellaneous primary metal industries. Available figures also show that in 1954 an average of 3,500 was employed in manufacturing stone, clay, and glass products, of which approximately 1,300 worked at concrete, gypsum, and plaster-products plants, 800 at cement plants, 600 at structural-clay-products plants, and 800 in plants in the miscellaneous category. Industrial inorganic chemicals was one of the largest mineral industries in the State and employed an average of 9,000 persons. Employment in the petroleum and coal-products industries averaged only 200 but was increasing owing to the opening of new refineries.

Wages paid in the mineral-manufacturing industries totaled $129.2 million. Additional details on wages and employment are given in tables 2 and 3.

TABLE 2.—Estimated employment of wage and salary workers in mining and metals in Washington 1947–54 [1]

	1947	1948	1949	1950	1951	1952	1953	1954
Mining	3,400	3,400	3,100	2,900	3,000	2,900	2,800	2,300
Primary and secondary ferrous metals	3,000	3,200	2,600	3,800	3,000	3,200	3,400	2,900
Primary and secondary nonferrous metals	6,000	6,800	6,200	7,800	7,000	8,800	9,500	9,300

[1] Compiled from Washington State Employment Security Department publication.

Estimated average weekly earnings in December 1954 were $88.71 in mining, $78.59 in primary and secondary ferrous metals, and $87.38 in nonferrous metals. The average weekly earnings in other industries included $83.45 for all manufacturing, $107.47 for contract construction, and $77.34 for communications and utilities.

In addition to the mineral values credited to Washington in table 1, some are omitted owing to lack of information. Many ores contain valuable minor constituents, such as arsenic, bismuth, cadmium, selenium, tellurium, gallium, and germanium. The quantities sometimes are not known and sometimes, though known by analyses, are not accounted for metallurgically in early processing stages or credited to mine of origin. These minor constituents are recovered at plants that frequently treat mixtures of materials from many sources, including residues obtained from the refining of such metals as copper and lead and those obtained in other ways. In many such instances it is impossible to allocate the mineral products by States of origin, and sometimes it is even difficult to obtain an accurate separation as to domestic and foreign sources. Another mineral product of value, the production of which usually cannot be separated as to source, is byproduct sulfuric acid.

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TABLE 3.—Average employment and wages paid in 1954 in selected industries covered by Washington Employment Security Act [1]

Industry	Average employment	Wages paid
Mining and quarrying:		
Metal mining:		
Copper-ore	318	$1,607,998
Lead and zinc-ore	355	1,704,637
Gold and silver-ore	192	865,467
Metal not elsewhere classified	41	139,951
Bituminous coal	677	2,925,159
Crude petroleum and natural gas	48	244,606
Nonmetallic mining and quarrying:		
Dimension-stone quarries	94	452,286
Crushed-stone quarries, other than limestone	107	497,725
Crushed-limestone quarries	79	318,242
Sand and gravel quarries, pits, and dredges	298	1,456,220
Clays, ceramics and refractory materials	105	431,748
Nonmetallic minerals, not elsewhere classified	11	27,892
Total mining and quarrying	2,325	10,671,931
Mineral manufacturing:		
Stone, clay, and glass products:		
Cement, hydraulic	809	3,569,281
Structural clay products	618	2,594,020
Pottery and related products	22	64,632
Concrete, gypsum, and plaster products	1,300	5,799,752
Cut-stone and stone products	36	120,482
Miscellaneous nonmetallic mineral products	684	3,097,827
Total stone, clay, and glass products	3,469	15,245,994
Smelting, refining, and casting:		
Blast furnaces, steelworks, and rolling mills	1,790	8,279,604
Iron and steel foundries	963	4,348,157
Smelting and refining of nonferrous metals	5,995	28,945,049
Rolling, drawing, and alloying of nonferrous metals	3,075	16,367,042
Nonferrous foundries	212	1,045,555
Miscellaneous primary metal industries	148	704,123
Total smelting, refining, and casting	12,183	59,689,530
Industrial inorganic chemicals	9,131	53,034,755
Products of petroleum and coal	197	1,189,215
Total mineral-manufacturing industries	24,980	129,159,494

[1] Compiled from Washington State Employment Security Department publications.

Defense Minerals Exploration Administration Program.—Projects of the Defense Minerals Exploration Administration (DMEA) program to assist systematic investigation of strategic and critical mineral occurrences were active as follows: 6 copper, 5 lead-zinc, and 1 each for copper-zinc, lead, and zinc.

Some production data for 1954 were collected jointly with the Bureau of the Census (United States Department of Commerce). Production totals will be compared with the Bureau of the Census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

REVIEW BY MINERAL COMMODITIES

METALS

Aluminum.—The output of primary aluminum in 1954 from the Aluminum Co. of America plants at Vancouver and Wenatchee, the Kaiser Aluminum & Chemical Corp. plants at Spokane and Tacoma and the Reynolds Metals Co. plant at Longview totaled 432,534 short

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TABLE 4.—Defense Minerals Exploration Administration contracts active during 1954

County and contractor	Property	Commodity	Contract		
			Date	Total amount	Government participation (percent)
CHELEAN					
Howe Sound Co	Holden	Copper	June 25, 1954	$309,990	50
Phantom Creek Copper, Inc	Pickwick	do	Apr. 9, 1952	7,600	50
FERRY					
Spokane Mining Syndicate, Inc	Talisman	Copper, zinc	Sept. 7, 1951	44,000	50
KING					
Western States Copper Corp	Rainey	Copper	Nov. 6, 1952	22,300	50
SKAGIT					
William Soren	Johnsburg	Lead	Oct. 15, 1953	38,000	50
SNOHOMISH					
Curtiss and Rogers	Mint	Copper	Oct. 7, 1952	17,600	50
Index Mining Co	Sunset	do	Feb. 20, 1953	115,000	50
STEVENS					
Chewelah Copper Co., Inc	Independence	do	Sept. 16, 1954	63,100	50
Grandview Mines	Hartbauer	Lead, zinc	Aug. 21, 1953	21,000	50
Do	Maki	do	Sept. 22, 1953	36,400	50
Mines Management, Inc	Advance	do	Apr. 29, 1952	59,150	50
Theodore Hasburg, and others	Scandia	Zinc	Aug. 15, 1952	29,260	50
Pacific Northwest Mining Co	Lucille	Lead, zinc	Dec. 14, 1951	37,284	50
Pioneer Mining Co	Long Shot	do	June 2, 1952	23,651	50

tons valued at $175,338,058. These totals represented gains exceeding 8 and 10 percent, respectively. The total output by aluminum plants in the State from World War II through 1954 approached 2½ million short tons, with a value of approximately $860 million. Alumina, the basic raw material for the production of aluminum metal, was imported from bauxite-processing plants operated by each company in various Southern and Eastern States.

The three companies continued expansion and improvement programs during the year. Kaiser announced plans to invest $1.5 million in fabricating equipment for the Trentwood rolling mill and completed installation of a fume control system at the company Mead plant near Spokane. Alcoa planned ingot-casting facilities for the Wenatchee plant, and the company also placed two new hydraulic extrusion presses in operaton at the Vancouver plant.

A report issued during the year [3] indicated the importance of the aluminum industry to the economy of the region in a statement to the effect that:

For every Northwest worker who received his pay check directly from one of the three aluminum producers in 1952 (7,600 employees during that year), the income of three other workers was directly traceable to the Northwest aluminum industry.

Copper.—Copper production decreased 3 percent and declined to the lowest point since 1947 owing mainly to a drop in output of the

[3] Green, Carleton, The Impact of the Aluminum Industry on the Economy of the Pacific Northwest. Report by Stanford Research Institute prepared for Aluminum Co. of America, June 1954.

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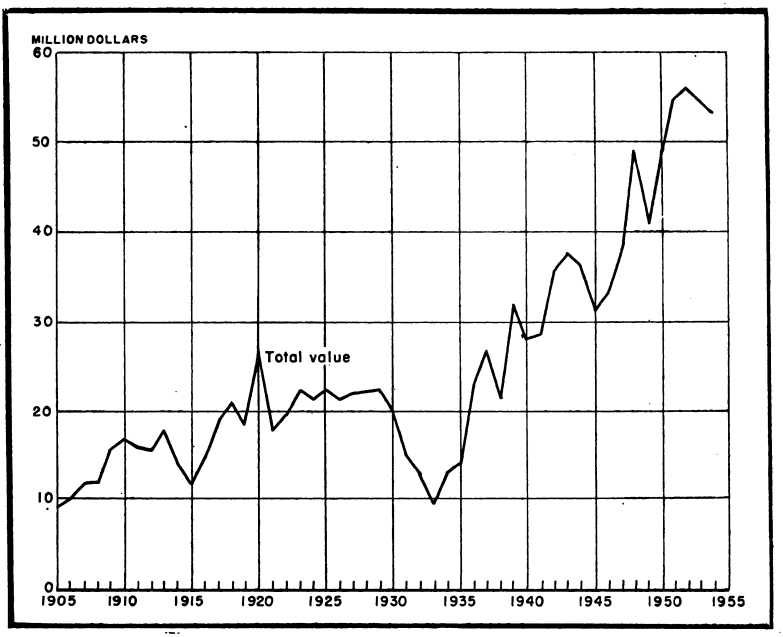

FIGURE 1.—Value of mineral production in Washington, 1905–54.

metal from the Howe Sound Co. Holden mine, Chelan County, the only large producer of copper in the State. A strike that closed the mine from October 24 to November 8 during a dispute over wages and fringe benefits and time lost in reassembling operating personnel after the end of the strike led to the decreased production. Except in the last 3 months of 1954, when the metal was diverted to industrial plants at the request of the Government because of short supplies, all copper from the Holden mine was purchased by the General Services Administration for the National Stockpile at 31½ cents a pound under terms of a contract that became effective September 1, 1953, and was to continue until December 31, 1955.

Copper ore also was produced at the Rainey mine on Quartz Creek, about 40 miles east of Seattle in King County; the Kromona mine, Sultan district, Snohomish County; and the Copper Mountain mine, Bossburg (Clugston Creek) district, Stevens County. Western States Copper Corp. of Seattle operated the Rainey mine and shipped concentrate and crude ore to a smelter. At the Kromona property Kromona Mines Corp. continued underground and surface development after a shutdown during the winter because of weather conditions and began production of copper concentrate in its new 100-ton flotation mill. The concentrate was shipped by truck to the Tacoma smelter. A new hoist was installed to raise supplies from the mill to the mine, which is 2,000 feet higher. Bonanza Lead of Colville operated the Copper Mountain mine from January 1 to August 1 and shipped concentrate from Palmer Siding.

In the northern Cascade Mountains, where the Holden mine is the only substantial producer at present, exploration projects were in

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progress at several properties. Bear Creek Mining Co., a subsidiary of Kennecott Copper Corp., did exploratory work at the Glacier Peak mine in Snohomish County; this deposit was located in 1900 and was drilled as early as 1917, but there had been no production. Rugged terrain, severe winters, and lack of access roads have limited work in the Glacier Peak area. DMEA projects were active at the Holden and Rainey mines and the Mint and Sunset claims in Snohomish County. In northeastern Washington DMEA contracts were in

TABLE 5.—Mine production of gold, silver, copper, lead, and zinc in 1954, by months, in terms of recoverable metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	4,920	22,970	350	449	1,739
February	5,960	28,200	280	839	1,760
March	6,590	30,910	390	1,004	2,099
April	6,310	27,840	354	793	1,904
May	5,150	26,430	312	966	2,134
June	5,990	28,280	296	841	2,165
July	4,680	25,170	284	924	2,006
August	6,080	25,350	320	1,041	1,692
September	5,370	26,320	250	915	1,730
October	5,380	24,220	224	803	1,664
November	5,110	23,595	248	713	1,479
December	5,200	24,450	328	650	1,932
Total	66,740	313,735	3,636	9,938	22,304

TABLE 6.—Mine production of gold, silver, copper, lead, and zinc, 1945–49 (average), 1950–54, and total, 1860–1954, in terms of recoverable metals [1]

Year	Mines producing [2]		Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1945–49 (average)	24	4	897,780	57,212	$2,002,434	314,663	$268,734
1950	27	6	1,279,595	92,117	3,224,095	363,656	329,127
1951	29	1	1,304,495	67,405	2,359,175	334,948	303,145
1952	28	1	1,402,472	54,776	1,917,160	315,645	285,675
1953	33	2	1,706,410	62,560	2,189,600	321,202	290,704
1954	24	6	1,552,141	66,740	2,335,900	313,735	283,946
1860–1954			[3]	2,699,302	73,230,893	15,506,479	11,531,962

Year	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	4,706	$1,703,236	5,142	$1,486,980	12,040	$2,963,699	$8,425,083
1950	5,057	2,103,712	10,334	2,790,180	14,807	4,205,188	12,652,302
1951	4,089	1,979,076	8,002	2,768,692	18,189	6,620,796	14,030,884
1952	4,357	2,108,788	11,744	3,781,568	20,102	6,673,864	14,767,055
1953	3,740	2,146,760	11,064	2,898,768	32,786	7,540,780	15,066,612
1954	3,626	2,145,240	9,938	2,723,012	22,304	4,817,664	12,305,762
1860–1954	112,985	36,661,845	145,768	31,239,034	283,181	61,601,768	214,265,502

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, and ore shipped to smelters during calendar year indicated.
[2] Does not include gravel washed.
[3] 1860–1903: Figure not available; 1904–54, 22,433,166 tons produced.

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effect at the Talisman mine of Spokane Mining Syndicate in Ferry County and the Independence property of Chewelah Copper Co. in Stevens County. Alpine Uranium Corp. acquired the Old Turk and Deer Trail copper mines in Stevens County and enlarged and modernized the Deer Trail mill.

Ferroalloys.—Keokuk Electro-Metals Co., Ohio Ferro-Alloys Co., and Pacific Northwest Alloys, Inc., operated ferroalloy plants at Wenatchee (Chelan County), Tacoma (Pierce County), and Mead

TABLE 7.—Gold produced at placer mines, 1945–49 (average) and 1950–54, by methods of recovery

Method	Mines producing	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	
				Total	Average per cubic yard
Nonfloating washing plants:[1]					
1945–49 (average)	1	4,520	15	$539	$0.119
1950	1	8,000	31	1,085	.136
1951	1	5,100	13	455	.089
1952					
1953	2	550	28	980	1.782
1954	4	3,400	106	3,710	1.091
Small-scale hand methods:					
1945–49 (average)	2	238	7	252	1.059
1950	5	1,100	8	280	.255
1951					
1952	1	60	3	105	1.750
1953	[2]	[2]	1	35	
1954	2	1,150	12	420	.365
Grand total placers:					
1945–49 (average)[4]	3	7,458	42	1,484	.199
1950	6	9,100	39	1,365	.150
1951	1	5,100	13	455	.089
1952	1	60	3	105	1.750
1953	2	[3] 550	29	1,015	[5] 1,782
1954	6	4,550	118	4,130	.908

[1] Includes all placer operations using power excavator and washing plant, both on dry land; an outfit with movable washing plant is termed a "dry-land dredge."
[2] From property not classed as a mine.
[3] Figure not available.
[4] Includes 99 ounces of gold from dragline dredges.
[5] Excludes small-scale hand methods.

TABLE 8.—Mine production of gold, silver, copper, lead, and zinc in 1954, by classes of ore or other source materials, in terms of recoverable metals

Source	Number of mines	Material sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode ore:							
Dry gold, and copper [1]	6	558,753	66,571	275,689	7,233,400	100	272,000
Dry silver	1	30	1	284			
Lead	8	600		1,379		28,300	5,900
Lead-zinc	8	992,608	50	36,332	36,600	19,847,600	44,318,100
Zinc	1	150		31	2,000		12,000
Total "lode material"	24	1,552,141	66,622	313,715	7,272,000	19,876,000	44,608,000
Gravel (placer operations)	6	[2]	118	20			
Total, all sources	30	1,552,141	66,740	313,735	7,272,000	19,876,000	44,608,000

[1] Combined to avoid disclosure of individual company operations.
[2] 4,550 cubic yards.

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TABLE 9.—Mine production of gold, silver, copper, lead, and zinc in 1954, by methods of recovery and types of material processed, in terms of recoverable metals

Type of material processed and method of recovery	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Lode:					
Cyanidation	4,912	51,632			
Concentration and smelting of concentrates	40,710	236,157	7,270,100	19,861,100	44,607,700
Direct smelting	21,000	25,926	1,900	14,900	300
Total lode	66,622	313,715	7,272,000	19,876,000	44,608,000
Placer	118	20			
Grand total	66,740	313,735	7,272,000	19,876,000	44,608,000

TABLE 10.—Mine production of gold, silver, copper, lead, and zinc in 1954, by counties, in terms of recoverable metals

County	Mines producing		Gold (lode and placer)[1]		Silver (lode and placer)[2]	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Asotin and Benton [3]		5	109	$3,815	18	$16
Chelan, Ferry, and King [3]	5		66,494	2,327,290	274,058	248,036
Okanogan and Snohomish [3]	4	1	61	2,135	1,361	1,232
Pend Oreille and Stevens [3]	15		76	2,660	38,298	34,662
Total	24	6	66,740	2,335,900	313,735	283,946

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Asotin and Benton [3]							$3,831
Chelan, Ferry, and King [3]	3,534	$2,085,060			142	$30,672	4,691,058
Okanogan and Snohomish [3]	24	14,160	5	$1,370	2	432	19,329
Pend Oreille and Stevens [3]	78	46,020	9,933	2,721,642	22,160	4,786,560	7,591,544
Total	3,636	2,145,240	9,938	2,723,012	22,304	4,817,664	12,305,762

[1] Source of gold: 66,622 ounces from lode mines and 118 ounces from placers.
[2] Source of silver: 313,715 ounces from lode mines and 20 ounces from placers.
[3] Combined to avoid disclosure of individual company operations.

(Spokane County), respectively. Ferroalloy output in the State increased substantially over 1953; ferrosilicon and ferrochromium were produced. Operations at the Mead plant, which was leased in 1953 and from which magnesium metal formerly was produced, were scheduled for expansion under a contract signed by the company and the Government for conversion into ferrochrome of chrome concentrates stockpiled near Nye, Mont., and Coquille, Oreg. The concentrate stockpiled at Nye was produced for the Government during World War II from deposits in Stillwater County, Mont., by the Anaconda Copper Mining Co.; the Coquille concentrate was produced from Oregon beach sands for the Government's Metals Reserve Corporation, also during World War II.

Gold.—Increased production from the Knob Hill mine (gold ore), Ferry County, and the Holden mine (copper ore), Chelan County,

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more than offset a decline in output from the Gold King mine (gold ore), Chelan County, and brought about a 7-percent increase in gold production, raising the annual yield to the highest in 3 years. The three mines produced 99 percent of all gold recovered in Washington in 1954. Lead-zinc operations in Pend Oreille and Stevens Counties and copper mines in King and Snohomish Counties produced small quantities of gold. Production from placer deposits totaled 118 ounces, nearly all of which was recovered by operations at Blalock Island on the Columbia River in Benton County.

The Knob Hill mine of Knob Hill Mines, Inc., was the largest producer, followed in order of output by the Gold King mine, Lovitt Mining Co., Inc., and the Holden mine, Howe Sound Co., Chelan Division. During the year Knob Hill Mines opened a new ninth level at a depth of 1,200 feet (125 feet below the previous workings) at its mine near Republic, and it was reported that development on the new level could add several years to the life of the property. The company continued to mine under lease the portion of the Day Mines, Inc., Aurum property immediately adjacent to the Knob Hill mine. All mining was done through Knob Hill entries, since the leased ground is a continuation of the principal Knob Hill vein system. Mill products were gold-silver flotation concentrate and precipitate recovered in cyaniding flotation-cell tailings. Plans to increase output from the Gold King mine near Wenatchee were not carried out, according to Lovitt Mining Co., Inc., because a limit of 4,000 tons of ore from the mine each month was set by the smelter which processes the ore.

In December the Bureau of the Mint announced that the United States Assay Office in Seattle would be closed in January 1955. Established in 1898, the office purchased gold bullion, amalgam, and nuggets from Alaska mines as well as from mines in the Pacific Northwest.

Lead.—A 10-percent drop in quantity and 6-percent decrease in value of lead mined was recorded, owing to temporary closure of 2 major lead-zinc mines for 5 months. A strike closed the Grandview mine, Pend Oreille County, in August and idled 48 workers until early in January 1955. The mine was operated at capacity before the strike by American Zinc, Lead & Smelting Co. Goldfield Consolidated Mines Co. resumed production at the Deep Creek mine, Stevens County, in May after a partial recovery in lead and zinc prices; this operation had been shut down late in 1953. Increased output of lead by Pend Oreille Mines & Metals Co. at the Pend Oreille mine prevented a larger drop in the quantity of the metal recovered in the State. The company was able to mine ore higher in lead content than in zinc to take advantage of the better lead price, and this brought about a substantial increase in lead output at the mine and an abrupt drop in zinc production compared with 1953. Production of both lead and zinc at the American Smelting & Refining Co. Van Stone mine, Stevens County, was advanced over the previous year.

In order of output, the largest producing mines were the Pend Oreille, Grandview, Van Stone, and Deep Creek. These four supplied 99 percent of all lead produced. Except for a small tonnage from Okanogan County, all lead was mined in the lead and zinc dis-

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tricts in Pend Oreille and Stevens Counties in the northeastern part of the State. In this area active mines included, in addition to the four largest producers, King Tut and Oriole, Metaline Falls district, Pend Oreille County; Admiral, Electric Point, Gladstone, Last Chance, Lead King, and Lead Trust in Northport (Aladdin) district, Stevens County; and Long Shot in Old Dominion district, Stevens County. At the small mines output showed the effects of curtailments in 1952 and 1953 following reductions in the price of lead and zinc; only 26 tons of lead was produced compared with 300 tons in 1953. Fourteen mines in the 2 counties recorded some production of lead, compared with 20 mines in 1953. Exploration by drilling and drifting at lead-zinc mines similarly was restricted, although DMEA contracts were in effect at the Hartbauer, Maki, Advance, Lucille, and Long Shot properties in Stevens County. In mine development the principal project was at the Pend Oreille mine, where the main incline was extended 508 feet, making the total length of the shaft 3,842 feet. The proportion of ore extracted at this mine by trackless mining methods was increased from 75 percent of the total at the beginning of the year to 95 percent in December, and a third 800-ton flotation unit was added to the east mill.

Silver.—Although silver did not rank with gold, copper, lead, and zinc in value of production, the metal was an important constituent of ore produced at many mines in Washington. Production declined to the lowest since 1947 and 2 percent below the 1953 output as the result of a decline in output of base-metal ores, and consequent drop in recovery of byproduct silver, in Pend Oreille and Stevens Counties. Production from three mines in Chelan and Ferry Counties, which supplied most of the State output of silver, was increased over 1953 and partly made up for the decline in the quantity of silver recovered from base-metal ores in Pend Oreille and Stevens Counties. These mines were the Knob Hill and Gold King (gold ore) and the Holden (copper ore). The three mines produced 87 percent of the State total, compared with 78 percent the previous year.

Silver recovered in Pend Oreille and Stevens Counties dropped from 68,344 ounces in 1953 to 38,928 in 1954, with lowered output of the metal reported at the Pend Oreille, Grandview, and Deep Creek mines and several smaller base-metal operations. The output of silver from the Van Stone mine in the same area, on the other hand, was about the same as in 1953. Of Washington's production, nearly 88 percent came from gold and copper ores, 8 percent from lead-zinc ores, and less than 1 percent from lead, zinc, and silver ores and gold placers.

Tungsten.—The quantity and value of output of tungsten ore and concentrate (WO_3 content) from 4 operations were more than 3 times the 1953 totals. Production, measured in terms of recoverable content of ore and concentrate shipped from mines, reached 18 short tons (60 percent WO_3 basis) valued at $65,812. The four properties from which production was reported were the Kelly Camp mine (Kelly Camp Tungsten Co.), Ferry County; and the Addy mine (Addy Development Co.), the Germania Consolidated mine (Germania Consolidated Mines, Inc., and W. H. Traver and Henry Ewing), and the Germania mine (Penticton Tungsten Mines, Ltd.), all in Stevens County. A quantity of concentrate was obtained by W. H. West from the Little King mine, Stevens County, and in Snohomish County,

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a small quantity of tungsten concentrate was recovered by Kromona Mines Corp. as a byproduct of company operations at the Kromona mine; however, no shipments were made from either property.

Other tungsten activity included exploration and development work by Big Q Tungsten Mine, Inc., at the Big Q mine in Stevens County; Sunshine Mining Co. at the Little King prospect, Stevens County; Border Lord Mining Corp. at the Border Lord mine, Okanogan County and by Paul Floyd and Frank Birch at the Addy mine, Stevens County, under a lease and purchase option agreement. Testwork by the Bureau of Mines on low-grade ferberite-scheelite ores from the Germania Consolidated property indicated that acceptable concentrate could be produced.

Uranium.—Washington became a uranium-producing State with shipment of a carlot of ore containing about 0.3 percent uranium oxide from Spokane to an Atomic Energy Commission processing plant at Salt Lake City, Utah, on December 16. The ore came from a deposit discovered in the spring by John and James LeBret on the Spokane Indian Reservation in southern Stevens County. Exploration after the discovery indicated that a sizable deposit of shipping-grade ore had been found; and Midnite Mines, Inc., a company organized by the LeBret brothers and four other members of the Spokane Indian tribe, was formed. The discovery led to a rush of leasing activity on lands adjacent to the reservation boundary; exploration on the reservation itself was being controlled by the Spokane Indian Tribal Council and the Portland-area office of the Bureau of Indian Affairs. Other uranium occurrences were reported in Stevens and Ferry Counties.

Zinc.—Decreased production of zinc by three of the four largest mines reduced output by nearly one-third from the record high for the State reached in 1953 and reversed a series of annual gains that had been continuous since 1949. The Deep Creek mine was idle until May, following a shutdown in 1953 because of depressed market conditions for lead and zinc; the Grandview mine was closed by a labor dispute for the last 5 months of the year; and the Pend Oreille mine, although in operation throughout 1954, produced a much smaller tonnage of zinc than in the previous year. Output from the Van Stone open-pit mine, on the other hand, was greater than in 1953; and this operation, which supplied both lead and zinc but was predominantly a zinc producer, exceeded all other properties in zinc tonnage by a wide margin. The Van Stone mine was developed by American Smelting & Refining Co. and began producing late in 1952. The zinc produced has been purchased by the Government for the National Stockpile at 15½ cents per pound; however, this contract was completed before the end of 1954, and output during the remainder of the year was marketed through regular channels. It was reported that the operation was marginal at the prevailing market price for zinc but was being maintained in the hope that the price would increase. About 70 men were employed at the mine and 1,000-ton zinc-lead concentrator.

Pend Oreille Mines & Metals Co. resumed shipment of zinc concentrate in October after stockpiling concentrate at the mill for nearly a year because of low prices. At the Howe Sound Co. Holden mine in Chelan County the zinc circuit of the 2,000-ton flotation mill was

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shut down almost the entire year because of an unfavorable price-cost ratio, and a large proportion of the zinc was spilled in the tailings. The mill produces copper concentrate chiefly; but in past years, when prices have been higher, zinc concentrate has been an important byproduct from Holden ore, and the operation has rated as one of the larger zinc producers in the State.

As in previous years, most of the zinc was mined in the lead-zinc districts in Pend Oreille and Stevens Counties. DMEA contracts were in effect at several lead-zinc mines in these counties (see Lead). DMEA work also was done at the Scandia zinc property in Stevens County and the Talisman copper-zinc mine in Ferry County.

NONMETALS[4]

Abrasive Materials.—Minerals Products Corp., Seattle, reported an output of grinding pebbles from its Chewelah pit in Stevens County at the same rate as 1953. The company also prepared blast sand.

The Carborundum Co., Vancouver, Clark County, manufactured silicon carbide for abrasive and refractory purposes. Most of the silica used was shipped from Oregon.

Barite.—The Manufacturers Mineral Co., Seattle, reported that there was no barite production from its Madsen open pit near Addy, Stevens County. Output from this property in 1953 was the first commercial production of barite in the State for a number of years.

Cement.—Although the quantity of cement produced and shipped by the 6 manufacturing plants in the State decreased about 3 percent below 1953, it was still the principal mineral commodity processed from locally mined raw materials. Value of shipments declined only slightly because of a price increase early in 1954 to offset growing labor and material costs. Year-end stocks increased substantially over the previous year.

Five cement-manufacturing companies were active during 1954: Superior Portland Cement, Inc., with plants at Seattle, King County, and at Concrete, Skagit County; Lehigh Portland Cement Co., Metaline Falls, Pend Oreille County; Olympic Portland Cement Co., Ltd., Bellingham, Whatcom County; Northwestern Portland Cement Co., Grotto, King County; and Ideal Cement Co., Irvin, Spokane County (took over assets of Spokane Portland Cement Co.). Superior Portland Cement, Inc., continued to be the largest cement producer in the State. Lehigh Portland Cement Co. and Olympic Portland Cement Co., Ltd., showed substantial shipment gains despite the overall drop in production.

Shipments from plants in eastern Washington counties increased slightly, but those from the more densely populated western counties declined about 8 percent. This decline was due to lessened demand in Alaska and British Columbia and to completion of major concrete work at dam projects in the western part of the State. Demand in eastern Washington was maintained by dam- and irrigation-project needs.

Clays.—The quantity and value of fire-clay output increased about 6 and 5 percent, respectively, over 1953; miscellaneous clay production declined 1 percent. Heavy clay products were made at 11 plants:

[4] Petersen, Norman S., commodity-industry analyst, assisted in the preparation of the Nonmetals section.

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3 each in King and Clark Counties; 2 in Spokane County; and 1 each in Lewis, Yakima, and Snohomish Counties. In addition, refractory products were manufactured in King and Spokane Counties (1 plant in each) and pottery at 2 plants in King County.

King County continued to be the center of the ceramic industry in the State. Gladding, McBean & Co., Builders Brick Co., and Abrahamson Brick Co. made structural-clay products. Firebrick and block were manufactured by Gladding, McBean & Co., and the Auburn Pottery Co., Inc., and Washington Pottery Co. made flowerpots. In Spokane County plastic and miscellaneous clays were mined by Gladding, McBean & Co., Washington Brick & Lime Co., and Charles & Frank Pirello. Clay mined at the Clay City pit in Pierce County was used by the Builders Brick Co. for making heavy clay products. Other producing counties included Stevens, Yakima, Snohomish, Lewis, and Clark.

Diatomite.—Output of diatomite declined slightly from 1953. The Kenite Corp. mined diatomite from its open pit 18 miles southeast of Quincy, Grant County. Crude output was trucked to the company processing plant at Quincy for crushing, drying, classifying, and other treatment. The products were marketed for filter and filler purposes.

Western Ventures, Inc., Spokane, almost tripled the output of its Squaw Creek open-pit deposit near Ellensburg, Kittitas County. After processing, the product was sold for use as filler material.

Gem Stones.—Various semiprecious minerals and silicified wood suitable for gem stones and display specimens after cutting and polishing are distributed widely throughout the State. There were no large-scale commercial operations, but collectors and mineral dealers were active.

Gypsum.—Completion in September 1954 of the Kaiser Gypsum Co., Inc., gypsum-products plant, Seattle, the only new calcining and prefabricating plant to begin operation in the United States in the past 2 years, was an important industrial development. It is the only complete gypsum-products plant in Oregon, Washington, and Idaho and is expected to supply a large proportion of the demand of those States and Alaska. Gypsum lath, wallboard, sheathing, and base-coat plaster were produced. Gypsum for the plant will be supplied from the company-owned deposit on San Marcos Island in the Gulf of California. An article describing the new plant was published.[5]

Agro Minerals, Inc., mined gypsite from its Poison Lake deposit near Tonasket, Okanogan County. Production surpassed that in 1953 by about 1,200 tons. The product was used for agricultural purposes. Columbia Gypsum Products Co., Spokane, operated a plant at Green Acres. Agricultural gypsum and gypsum for use as a cement retarder were produced from ore shipped from the company-owned quarry at Lake Windermere, British Columbia. Plans were announced to expand plant facilities to make wallboard and lath.

Lime.—The output of quicklime by Roche Harbor Lime & Cement Co., San Juan County, the only producer in the State, increased almost 30 percent above 1953. The quicklime was used principally for building and chemical purposes. The United States Gypsum Co.

[5] Lenhart, Walter B., Automatic Controls in Newest Gypsum Plaster and Wallboard Plant: Rock Products, December 1954, pp. 72-86, 118-119.

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lime plant at Evans, 16 miles north of Colville, Stevens County, which had been closed in 1953, was dismantled by the Alaska Junk Co.

Magnesium Minerals.—Northwest Magnesite Co., Chewelah, Stevens County, continued to be the Nation's leading producer of natural magnesite. The quantity and value of production from the company-owned Red Marble quarry were less than half of the 1953 total. Decreased demand for refractories by the steel industry was reflected in closure of the quarry and plant for about 11 weeks during early spring and midsummer. During the shutdowns an automatic loader was installed on the Finch tramway, the grinding capacity at the Finch flotation mill was doubled, and the traction cable from the Keystone and Red Marble quarries was lengthened to 16 miles.[6]

Agro Minerals, Inc., recovered epsomite from its Poison Lake deposit near Tonasket, Okanogan County.

A small quantity of olivine for use as roof chips was produced by Scheel Olivine, Inc., Hamilton, Skagit County. A mill was completed during the year to process material from the mine, about 17 miles north of Hamilton in the Twin Sisters Mountains. Olivine can be used as a chemical and ceramic raw material, as a refractory, and for molding sand and other foundry applications, according to a report by the University of Washington.[7]

Pumice.—The output of pumice from Chelan County (the only producing county) was about 20 percent less than 1953. Arne Sorlie and Bunny & Villela were the principal producers; a small quantity was reported by C. L. Griffith from the Lake Creek pumice pit. All of the marketed product was used for lightweight-concrete aggregate. Sources of lightweight aggregate in the West were discussed in an article.[8]

Sand and Gravel.—Gross output of 16 million tons of sand and gravel valued at $13.6 million was divided between commercial, 11 million tons ($10 million), and Government-and-contractor, 4.9 million tons ($3.4 million). Comparable figures for 1953 were commercial, 6 million tons ($4.8 million), and Government-and-contractor, 5.2 million tons ($4.5 million). Production was reported from 37 of the 39 counties in the State. Counties having an output in excess of a million tons were King, Klickitat, Pierce, and Spokane.

The apparent 5.2-million-ton rise in commercial sand and gravel production can be attributed entirely to better statistical coverage of the active operations, as a result of information gained from the 1953 canvass, and to the excellent cooperation of the industry.

Based on value, 49 percent of the output was used for road building and maintenance, 44 percent for building construction, and a small percentage for railroad ballast and other miscellaneous purposes. Small quantities of molding, glass, engine, and blast sands also were produced during the year.

A discussion of the sand and gravel industry was published.[9]

Silica.—The output of silica of the Pacific Silica Co. from the Latshaw deposit near Deer Park, north of Spokane, was used largely for manufacturing ferrosilicon. At Chewelah, Stevens County, the

[6] Engineering and Mining Journal, vol. 155, No. 6, June 1954, p. 146.
[7] Snyder, William A., Olivine Fines for Foundry Use: Trend in Engineering, University of Washington, vol. 6, No. 3, July 1954, pp. 5–7, 32.
[8] Chesterman, Chas. W., Lightweight Aggregates of the West: Min. Cong. Jour., vol. 40, No. 12, December 1954, pp. 67–69.
[9] Walker, Stanton, Merchandisable Sand and Gravel: Pit and Quarry, No. 5, May 1954, pp. 134–138, 150.

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TABLE 11.—Sand and gravel sold or used by producers, 1953–54, by classes of operation and use

	1953			1954			Percent of change in—	
	Short tons	Value		Short tons	Value		Tonnage	Average value
		Total	Average		Total	Average		
COMMERCIAL OPERATIONS								
Sand:								
Molding	3,425	$17,175	$5.01	3,655	$13,234	$3.62	+7	−28
Building	1,337,385	1,183,895	.89	2,074,404	1,957,787	.94	+55	+6
Road material	440,420	230,155	.52	560,355	423,122	.76	+27	+46
Other	54,320	101,655	1.87	90,008	132,121	1.47	+66	−21
Total sand	1,835,550	1,532,880	.84	2,728,422	2,526,264	.93	+49	+11
Gravel:								
Building	2,157,435	1,793,445	.83	3,415,190	3,077,110	.90	+58	+8
Road material	1,169,295	1,093,783	.94	3,985,095	3,819,553	.96	+241	+2
Railroad ballast	337,320	177,090	.52	431,382	288,307	.67	+28	+29
Other	454,130	241,070	.53	595,995	455,058	.76	+31	+43
Total gravel	4,118,180	3,305,388	.80	8,427,662	7,640,028	.91	+105	+14
Total sand and gravel	5,953,730	4,838,268	.81	11,156,084	10,166,292	.91	+87	+12
GOVERNMENT-AND-CONTRACTOR OPERATIONS								
Sand:								
Building	11,035	17,170	1.56	330,170	298,036	.90	+2892	−42
Road material	446,310	417,790	.94	99,888	64,799	.65	−78	−31
Total sand	457,345	434,960	.95	430,058	362,835	.84	−6	−12
Gravel:								
Building	927,105	649,120	.70	861,777	698,397	.81	−7	+16
Road material	3,844,655	3,395,445	.88	3,596,768	2,367,490	.66	−6	−25
Total gravel	4,771,760	4,044,565	.85	4,458,545	3,065,887	.69	−7	−19
Total sand and gravel	5,229,105	4,479,525	.86	4,888,603	3,428,722	.70	−7	−19
TOTAL ALL OPERATIONS								
Sand:								
Molding	3,425	17,175	5.01	3,655	13,234	3.62	+7	−28
Building	1,348,420	1,201,065	.89	2,404,574	2,255,823	.94	+78	+6
Road material	886,730	647,945	.73	660,243	487,921	.74	−26	+1
Other	54,320	101,655	1.87	90,008	132,121	1.47	+66	−21
Total sand	2,292,895	1,967,840	.86	3,158,480	2,889,099	.91	+38	+6
Gravel:								
Building	3,084,540	2,442,565	.79	4,276,967	3,775,507	.88	+39	+11
Road material	5,013,950	4,489,228	.90	7,581,863	6,187,043	.82	+51	−9
Railroad ballast	337,320	177,090	.52	431,382	288,307	.67	+28	+29
Other	454,130	241,070	.53	595,995	455,058	.76	+31	+43
Total gravel	8,889,940	7,349,953	.83	12,886,207	10,705,915	.83	+45	-------
Total all sand and gravel	11,182,835	9,317,793	.83	16,044,687	13,595,014	.85	+43	+2

Minerals Products Corp. prepared silica and ground silica sand. The silica product was used as abrasive, foundry, traction, and filter sand. The Bristol Silica Co., Grants Pass, Oreg., investigated a quartzite deposit west of Colville, Stevens County.

Stone.—The gross output and value of stone for all purposes were 5.4 million tons valued at $9.5 million and were divided between commercial, 3.8 million tons ($8 million), and Government-and-contractor, 1.5 million tons ($1.6 million). Comparable figures for 1953 were

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commercial 2.4 million tons ($3.7 million) and Government-and-contractor 2.1 million tons ($2.2 million). Production was reported from 28 of the 39 counties in the State.

In the case of commercial production, the increased total was due to inclusion in State mineral-production statistics of limestone used in manufacturing cement and lime. Previously this limestone was excluded to avoid duplicating product values. Under the new procedure limestone used for cement and lime was added to the stone total, and an adjustment, was made to eliminate duplicate values in table 1. Total stone output is reflected more accurately under the new method.

Basalt, used for road construction, was the principal stone quarried; other uses were for riprap and railroad ballast. Output of limestone from 8 quarries for purposes other than cement and lime manufacture decreased in quantity and value about 14 and 30 percent, respectively.

TABLE 12.—Stone sold or used, 1953–54, by uses

Use	1953		1954	
	Short tons	Value	Short tons	Value
Agriculture (limestone)	68, 155	$309, 795	33, 615	$134, 645
Building (dimension stone)	6, 357	413, 265	7, 141	345, 393
Concrete, road metal, and screenings	3, 363, 002	3, 866, 598	[1] 3, 404, 642	3, 982, 926
Riprap	404, 700	373, 596	324. 270	364, 986
Railroad ballast	380, 450	409, 050	70, 842	87, 861
Terrazzo chips	2, 485	11, 785	([2])	([2])
Other [3]	213, 110	506, 760	1, 526, 380	4, 610, 723
Total	4, 438, 259	5, 890, 849	5, 366, 890	9, 526, 534

[1] Limestone and granite used for concrete and road metal included with "Other" to avoid disclosure of individual company operations.
[2] Included with "Other" to avoid disclosure of individual company operations.
[3] Used at metallurgical and chemical plants; sugar refineries; and in manufacturing paper, cement, mineral wool, and poultry grit and for other unspecified purposes.

Distribution by use was about 60 percent for chemical purposes, 20 percent as agricultural limestone, 15 percent for road construction, and 5 percent as a metallurgical flux. Producing counties, in order of output, were Stevens, San Juan, Whatcom, Snohomish, and Pacific. Dimension stone was used for construction and decorative purposes. An increased demand for large, random-shaped stone for use as building veneer was reported.

Strontium.—The LaConner strontium mine on Fidalgo Island, Skagit County, was reported idle in 1954.

Talc (Soapstone).—The quantity and value of soapstone production declined about 35 percent below 1953. Four properties were active in Skagit County, the only producing area, compared with eight during the previous year. Northwest Talc & Magnesium Co. and Skagit Talc Products were the principal producers. Crude soapstone was ground by the producing company or by grinding plants in Washington and Oregon. The bulk of the ground product was used in insecticides; small quantities were used as a fertilizer mix and as paint filler.

Vermiculite (Exfoliated).—Vermiculite-Northwest, Inc., Spokane, produced exfoliated vermiculite for insulation purposes from unexpanded concentrate purchased from Zonolite Co., Libby, Mont.

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MINERAL FUELS

Carbon Dioxide.—Carbon dioxide from mineral waters in Klickitat County was converted to dry ice by the Gas-Ice Corp., Seattle. Production was about the 1953 rate. Two new wells were completed and another was started as part of the expansion program to increase daily output. The company operated a similar installation near Ashland, Jackson County, Oreg.

Coal.[10]—Production of coal in Washington continued to decline. Output was reported from 16 mines in 6 counties. Kittitas County was again the principal producer; King County recorded increased production, despite the overall decrease; and Thurston County had the only new operation (Stoker Coal Co., Tono mine). One mine in Lewis County closed during the year.

Two mines of the Northwest Improvement Co.—No. 3 (Ronald) and No. 9 (Roslyn)—were the largest producers in the State. Third in rank and first in King County was Franklin No. 10–No. 12 (Black Diamond) operated by the Palmer Coking Coal Co. Also important was the No. 1 mine (Bellingham) of the Bellingham Coal Mines Co., Whatcom County.

Peat.—Production increased 34 percent over the 1953 total, with a corresponding 47-percent increase in value. Washington continued to be the leading peat-producing State in terms of quantity produced. Twenty companies were active, 13 in King County, 3 in Thurston County, 2 in Snohomish County, and 1 in Spokane County and 1 in Mason County. Humus peat was the principal product. Peat is used predominantly for agricultural purposes as a soil conditioner and as a filler in mixed fertilizers.

Petroleum and Natural Gas.—The search for petroleum and natural gas continued with increased vigor. The principal interest was focused upon the western part of the State. Large acreage leases were made, and exploration crews of several leading companies were active. At least temporary disappointment was experienced when continued drilling by the Continental Oil Co. in Grays Harbor County failed to prove a commercial discovery after an initial showing of gas. Drilling near Toledo, Lewis County, failed to yield determinable results.

The Ferndale refinery of the General Petroleum Corp. began production in November. Its daily capacity was estimated at 35,000 barrels. Construction continued on the Shell Oil Co. refinery near Anacortes. Crude for these plants was to be supplied from Alberta through the recently completed Trans Mountain pipeline and from overseas sources by tanker. A products oil pipeline from Billings, Mont., to Spokane was put in service during midsummer.

Agreement was reached late in the year to supply natural gas to the Pacific Northwest from the San Juan Basin in New Mexico and Colorado and from the Peace River field in north-central British Columbia. According to the announcement, pipelines from both areas would be interconnected at the Canadian border near Vancouver. Gas deliveries would be made to the California area from a third pipeline, which would extend from the main line at a point in southwestern Idaho to the California-Nevada border near Reno.

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[10] Holmes, Clarence R., Annual Report of Coal Mines for the Year ending Dec. 31, 1954: State of Washington, Dept. of Labor and Industries, 1954, 17 pp.

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The competitive position of imported natural gas vs. existing sources of energy in the Pacific Northwest was stated in an article.[11]

REVIEW BY COUNTIES AND DISTRICTS

Adams.—Building sand was produced by the Othello Concrete Co. Gravel for roadwork was prepared by county and municipal road crews and for the State by contractors.

Asotin.—Washed sand for building purposes was prepared by Lewiston Pre-Mix Concrete Co. (previously the American Transit Mix Co.). Paving sand and gravel was produced by county road crews. Road metal was quarried by the J. F. Konen Construction Co., Inc., Lewiston, Idaho.

Snake River District.—Recovery of a small quantity of gold from stream gravels was reported by Clarence Spangler.

Benton.—Sand and gravel for construction, paving, and other purposes was produced by Layrite Concrete Products of Kennewick, Inc., and Matheson Sand & Gravel Co., Pasco. Road gravel was mined

TABLE 13.—Value of mineral production in Washington, 1953–54, by counties[1]

County	1953	1954	Minerals produced in 1954, in order of value
Adams	$68,770	$57,380	Sand and gravel.
Asotin	79,930	98,175	Sand and gravel, stone, gold.
Benton	309,941	136,249	Sand and gravel, gold, silver.
Chelan	3,893,003	4,052,862	Copper, gold, sand and gravel, silver, zinc, pumice, stone.
Clallam	34,750	(2)	Sand and gravel.
Clark	349,885	612,488	Sand and gravel, stone, clay.
Cowlitz	514,325	380,132	Stone, sand and gravel.
Douglas	653,090	227,338	Sand and gravel.
Ferry	(2)	(2)	Gold, silver, tungsten, sand and gravel, stone, zinc, copper.
Franklin	144,815	185,034	Sand and gravel, stone.
Garfield	31,805	(2)	Stone.
Grant	814,525	744,010	Sand and gravel, diatomite.
Grays Harbor	131,060	199,298	Sand and gravel, stone.
Island	7,800	54,311	Stone, sand and gravel.
Jefferson	292,000	189,692	Do.
King	7,239,079	7,735,333	Cement, sand and gravel, coal, stone, clay, copper, silver, gold.
Kitsap	208,770	122,344	Sand and gravel, stone.
Kittitas	3,075,583	2,625,146	Coal, sand and gravel, stone, diatomite.
Klickitat	48,240	1,472,188	Sand and gravel, stone, carbon dioxide.
Lewis	469,845	912,188	Sand and gravel, stone, coal, clay.
Lincoln	98,325	134,443	Sand and gravel.
Mason	3,470	51,520	Do.
Okanogan	185,895	606,802	Sand and gravel, gypsum, epsomite, lead, gold, zinc, silver.
Pacific	276,410	431,892	Stone, sand and gravel.
Pend Oreille	8,867,605	7,997,274	Cement, lead, zinc, sand and gravel, silver, stone, copper, gold.
Pierce	1,787,598	2,319,062	Sand and gravel, stone, clay, coal.
Skamania	30,670	95,374	Sand and gravel, stone.
Snohomish	863,958	1,300,921	Sand and gravel, stone, clay, copper, gold, silver.
Spokane	3,340,633	3,336,210	Cement, sand and gravel, stone, silica, clay.
Stevens	7,157,609	5,016,737	Zinc, magnesite, lead, stone, copper, tungsten, silver, clay, sand and gravel, ground sand and sandstone, quartz, gold, grinding pebbles.
Thurston	122,191	(2)	Sand and gravel, coal.
Walla Walla	350,065	178,359	Sand and gravel, stone.
Whatcom	2,684,383	(2)	Cement, coal, sand and gravel, stone.
Whitman	436,270	185,778	Stone, sand and gravel.
Yakima	264,744	830,019	Sand and gravel, stone, clay.
Undistributed[3]	9,740,178	11,011,456	
Total	54,577,000	53,300,000	

[1] No production was reported from Wahkiakum County.
[2] Included with "Undistributed" to avoid disclosure of individual company operations.
[3] Includes value of production from Columbia, San Juan, and Skagit Counties, combined to avoid disclosure of confidential data, and sand and gravel, stone, peat, and gem-stone production that cannot be assigned to specific counties.

[11] Iulo, Wm., Natural Gas in the Pacific Northwest: Washington State College, Bureau of Economics and Business Research, Bull. 25, 1954, 110 pp.

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by the county highway department. The Bureau of Reclamation used structural sand and gravel at its Yakima project.

Columbia River District.—Small quantities of gold and silver were recovered from placer operations by Fred Blake, Milo Boday, and J. A. Matney & Robert C. Tyler. Louis Tyacke washed 1,312 cubic yards of gravel and recovered a quantity of gold and silver. The operation was suspended in June.

Chelan.—The Aluminum Co. of America aluminum-reduction plant at Wenatchee produced steadily throughout the year; the plant began operating in June 1952. Plans for installing ingot-casting facilities, which would make possible the alloying and recasting of pig aluminum into ingot form, were announced. Also at Wenatchee, ferrosilicon was produced by Keokuk Electrometals Co.

Sand and gravel used for building, paving, and ballast was produced by four operators and the Northern Pacific Railway Co. Paving gravel was furnished under contract to the State highway department. Pumice was mined by Arne Sorlie at a pit near Twenty-five Mile Creek; by Bunny & Villela from their pit near Entiat; and by C. L. Griffith from the Lake Creek pit along the Entiat River, about 19 miles from Entiat. By the end of 1954 limestone requirements of the Grotto plant (King County), Northwestern Portland Cement Co., were being satisfied by the company-owned Soda Springs quarry. Sandstone for use as building veneer was quarried by the Wilkeson Wenatchee Stone Co. at the Dry Gulch quarry (owned by Walker Cut Stone Co., Inc.).

Chelan Lake District.—The quantity of ore milled at the Howe Sound Co. Holden mine was increased over 1953, although the output of recoverable copper and zinc declined. A strike lasting from October 24 to November 8 was settled when the company granted a general wage increase and fringe benefits patterned after the scales prevailing in the mining industry in Washington and the Coeur d'Alene region in Idaho. According to the company annual report, a drift on the horizon of the main haulage level, which was being driven with DMEA assistance to undercut a surface showing of copper, was advanced 1,031 feet. Unstable rock conditions, a continuing difficulty at the mine, impeded progress of the drift and hampered other mining activities. An article describing longhole drilling practices at the Holden mine was published during the year.[12]

Wenatchee River District.—Siliceous gold-silver ore was produced throughout the year from the Lovitt Mining Co. Gold King mine near Wenatchee. Production was a little less than 53,000 tons of ore, compared with nearly 58,000 tons in 1953. The ore was shipped to the American Smelting & Refining Co. Tacoma smelter, where the gold and silver values were recovered and the ore itself served as a fluxing agent.

Clallam.—Paving gravel was prepared by the Pieler Construction Co., Port Angeles, and by the county highway department.

Clark.—Output of aluminum metal at the Aluminum Co. of America plant at Vancouver was continued throughout the year. Developments at the plant included placing in service a $3,360,000 mill containing two 2,500-ton hydraulic extrusion presses, addition of

[12] Curzon, J. J., Longhole Drilling at Holden Mine—Greater Productivity, Lower Costs. Min. Eng., vol. 6, No. 9, September 1954, pp. 893-896.

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ingot-casting equipment, and expansion of wire and electrical conductor cable facilities. New employment at the plant as a result of these developments was expected to reach about 500 persons.

Sand and gravel valued at more than $400,000 was produced by 8 companies and the county highway department. Scoria for use as dimension stone and basalt for riprap and road metal were quarried by two companies and the county highway department. Structural clay products were manufactured by C. B. Muffett Brick Co., Hidden Brick Co., and the Wilde Co. The Carborundum Co. manufactured silicon carbide at its Vancouver plant.

Columbia.—A small quantity of paving sand and gravel was mined by James L. Lowry, Dayton.

Cowlitz.—Aluminum-metal production was continued throughout the year at the Reynolds Metals Co. reduction plant at Longview.

Stone valued at $320,900 was produced in the county. Basalt for riprap and road metal was quarried by 4 companies and county road crews. Paving and building gravel was prepared by the Woodland Sand & Gravel Co. Gravel for roadwork was mined by county road crews and for the State highway department by contractors.

Douglas.—Sand and gravel for building and paving purposes was produced by three operators. The Great Northern Railway Co. prepared engine sand and railroad ballast gravel. Paving gravel was furnished to the State highway department by contractors.

Ferry.—High- and low-grade tungsten concentrate was produced from the Kelly Camp mine near Republic by Kelly Camp Tungsten Co.

Contractors furnished paving gravel to the State and county highway departments. A small quantity of road metal was mined by county road crews.

Orient District.—Work on the DMEA project at the Talisman mine by Spokane Mining Syndicate, Inc., was continued in January and February. The company produced and shipped concentrate containing zinc, copper, and some silver; mining operations were confined to 15 days' work cleaning up old stopes. The property was abandoned in June.

Republic District.—Knob Hill Mines, Inc., continued operations at its Knob Hill mine near Republic throughout the year and also worked under lease a portion of the adjoining property, owned by Day Mines, Inc. The leased ground, called the Gold Dollar lease (also referred to as the Aurum lease), was a continuation of the principal Knob Hill vein system. Mining and milling of ore at the Gold Dollar lease was begun from the 600 level of the Knob Hill mine early in December 1953. Work on shaft sinking to open a new ninth level of the Knob Hill mine was reported early in 1954 and by fall the company had opened the downward extension of the ore body at that level. Silver-gold-ore output from the mine was reported to be about 200 tons daily in the latter part of the year.

Franklin.—Sand and gravel for building purposes was mined by the Connell Sand & Gravel Co. and F. H. Atlley & Co. Railroad ballast was produced by the Northern Pacific Railway Co. A small quantity of paving sand was used by the State highway department. Riprap, railroad ballast, and road metal were quarried.

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Garfield.—Stone for road metal was quarried by State and county highway departments.

Grant.—Building sand and gravel and paving gravel were produced by four operators. Diatomite output by the Kenite Corp., Quincy, declined about 11 percent below the 1953 total. Crude ore from the open-pit operation 18 miles southeast of Quincy was trucked to the company plant at Quincy for preparation before marketing.

Grays Harbor.—Sand and gravel used for building, paving, and miscellaneous purposes was produced by four companies. County road crews mined paving gravel. Basalt for road metal was quarried by Quigg Bros.-McDonald, Inc., Hoquiam, and for the State highway department. Graystone Concrete Products Co. reportedly merged with Grays Harbor Cement Products Co., Aberdeen; Lewis Materials Co., Centralia; Everett Concrete Products Co., Everett; Graystone Materials Co., Olympia; and Mason Materials Co., Shelton. Concrete masonry materials, concrete sewer and culvert pipe, ready-mix concrete, and precast concrete products were to be produced and marketed.

Island.—Crews of the State highway department quarried stone for use in road construction. A small quantity of special sand and paving gravel was processed by Gerald L. Thompson. Crews of the county highway department mined paving gravel.

Jefferson.—Basalt for riprap and road metal was quarried by the General Construction Co., Seattle. Paving gravel was furnished under contract to the county highway department by contractors.

King.—Metal processing and fabricating plants in King County included the Bethlehem Pacific Coast Steel Corp., Isaacson Iron Works, Northwest Steel Rolling Mills, Inc., Pacific Car & Foundry Co. and Seidelhuber Steel Rolling Mill Corp., as well as a number of foundries. Lead pipe, sheet, wool, and other special-use lead products were produced by Northwest Lead Co. primarily from lead reclaimed from battery plates and other scrap materials. Purchases of gold from various sources were continued at the United States Assay Office in Seattle; the Bureau of the Mint disclosed in December that the office would be closed after more than 50 years of service.

Nonmetallic commodities produced in the county were valued at over $7.5 million. In order of total value, the commodities were cement, sand and gravel, coal, stone, and clay. Superior Portland Cement, Inc., obtained limestone from the company-operated quarry at Concrete, Skagit County, and locally mined clay for use in manufacturing cement. The Northwestern Portland Cement Co. shipped limestone from its Soda Springs quarry, Chelan County. King County ranked second in value of sand and gravel output ($1,460,093). Glass and molding sands were produced by Smith Bros. Silica Sand Co. (Auburn) and the Cavanaugh Molding Sand Co. (Kennydale), respectively. Sand and gravel for building, paving, and miscellaneous applications was processed by 15 companies. The Meade Sand & Gravel Co. (Midway) and the Northern Pacific Railway Co. mined railroad ballast. Building and paving gravel was produced by the county, and sand and gravel was supplied to the United States Corps of Engineers under contract. Coal mines in the county supplied about 28 percent of the State output. Active operators were the Palmer Coking Coal Co., B & R Coal Co., J. A. Terteling & Sons,

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Draghi Coal Co., and Bianco Coal Mines. Production of coal in the county increased from 152,677 tons in 1953 to 161,000 tons in 1954, owing mainly to increased output from the Franklin No. 10–No. 12 mine of the Palmer Coking Coal Co. at Black Diamond. Limestone from the Marble quarry near Grotto was used by the Northwestern Portland Cement Co. According to terms of an agreement that terminated in December 1954, the cement company also operated the Roche Harbor quarry owned by the Roche Harbor Lime & Cement Co. Limestone from British Columbia was processed by J. A. Jack & Sons, Seattle, for agricultural, chemical, and metallurgical applications. Riprap and road metal were prepared by three commercial operators and the Northern Pacific Railway Co. Gladding, McBean & Co. operated a plant at Renton to manufacture firebrick and block. Heavy clay products were made by the Abrahamson Brick Co. and Builders Brick Co. Flowerpots and pottery were manufactured by the Auburn Pottery Co., Inc., and the Washington Pottery Co. Gypsum lath, wallboard, and sheathing were among the products made at the new Kaiser Gypsum Co., Inc., plant in Seattle. Output of the plant will be sent to markets in the Pacific Northwest States and Alaska. Peat was produced by 13 companies in the county.

Taylor River District.—Shipment of a quantity of copper ore containing some gold and silver was reported from the Rainey property by Western States Copper & Uranium Corp.

Kitsap.—Building and paving sand and gravel was produced by three commercial operators. County engineering crews mined sand and gravel for roadwork. Contractors furnished the United States Army Corps of Engineers with sand and gravel. Basalt for road construction was used by the State highway department.

Kittitas.—Total nonmetallic mineral production in the county was valued at over $2.6 million. Coal was mined by the Northwest Improvement Co. and the Roslyn-Cascade Coal Co. Sand and gravel for building purposes was mined by Ellensburg Cement Products, Inc. State and county highway crews used paving sand and gravel. The Chicago, Milwaukee, St. Paul & Pacific Railroad Co. produced railroad ballast. Road metal (basalt) was quarried by county road crews. Diatomite production by Western Ventures, Inc., Spokane, during 1954, the second year of operation, almost tripled the initial production; diatomite from the Squaw Creek mine was processed at the company plant near Ellensburg.

Klickitat.—Sand and gravel production valued at over $1.3 million ranked Klickitat County third in output of these commodities. The Bingen Sand & Gravel Co. and the Curtis Gravel Co. produced sand and gravel for building and paving purposes. County highway crews produced gravel for roadwork, and contractors supplied construction sand and gravel to the United States Army Corps of Engineers. Basalt for use as road metal was quarried by the county. Carbon dioxide recovered from mineral waters was processed to dry ice by the Gas-Ice Corp. at its Klickitat plant.

Lewis.—Gravel for paving and miscellaneous purposes was supplied by the Cowlitz Construction Co. and the Pacific Sand & Gravel Co. The Bureau of Public Roads and the State and county road crews used sand and gravel. Basalt was quarried by the Pacific Sand

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& Gravel Co., Northern Pacific Railway Co., and county highway crews. Production of coal totaled 30,485 tons. Contributing to the output were the Black Prince Coal Co., Monarch Coal Co., and the Stoker Coal Co. Heavy clay products were manufactured by the Chehalis Brick & Tile Co. from clay mined at its own pit.

Lincoln.—Paving sand and gravel was produced by crews of the county highway department, and contractors furnished gravel for State highway work.

Mason.—The Johns Creek Sand & Gravel Co. and the Mason Materials Co. processed sand and gravel for building and roadwork. Paving gravel also was produced by county highway crews. Peat was produced by 1 company.

Okanogan.—Additional construction on a mine access road was the only activity reported by Border Lord Mining Co. at its tungsten property west of Loomis.

Sand and gravel mainly for construction purposes was produced by four commercial operators and by contractors for the United States Army Corps of Engineers. Gypsite was mined by Agro Minerals Inc., from its Poison Lake deposit near Tonasket. Most of the production was used for agricultural applications. A small quantity of epsomite was recovered by the company from the same deposit.

Conconully (Ruby) District.—A. E. Kaiser (Conconully Mines, Inc.) operated the Mohawk and Peacock properties during the latter part of the year under lease from Sunny Peak Mining Co. and produced a quantity of lead ore containing recoverable quantities of silver, copper, lead, and zinc. The ore was treated at the leased American Graphite Co. flotation mill near Omak. Sunny Peak Mining Co. conducted exploratory work for 9 months at the Gubser property, which adjoins the Mohawk, using equipment brought in from an abandoned mine in Sanders County, Mont.

Loomis—Oroville District.—S. B. Gjerde washed stream gravels and recovered a small quantity of gold and silver.

Methow District.—The Alder Gold-Copper Co. property near Twisp was inactive during most of the year. An exploration and development program was begun in November at the property, which produced a considerable tonnage of copper-zinc ore in 1953 until closed late in the year because of low zinc prices.

Nespelem District.—The Garrett mine, last worked during World War II by Grand Coulee Mines, yielded a small quantity of silver ore later in the year. The operation was conducted by Ruby Silver Mines, Inc.

Pacific.—Stone valued at $343,700 was produced in the county. Limestone for agricultural applications was quarried part of the year at the Bear River property of the Columbia River Lime Co., Vancouver; basalt output was reported by A. H. Beatty and A. W. Hammond, both of South Bend, and by the Willapa Harbor Quarries, Raymond. This company also processed paving gravel. The Naselle Rock Co. produced crushed rock that was used by the State and county for highway maintenance.

Pend Oreille.—Pend Oreille, the first ranking county in value of total mineral output, placed fourth in value of nonmetallics. Production of cement by the Lehigh Portland Cement Co., Metaline Falls, was increased substantially. Limestone, shale, and quartzite

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used at the plant were mined locally. Romero Bros., Newport, produced building sand and gravel, and county road crews processed gravel for highway maintenance. The county quarried basalt for highway construction.

Metaline District.—The Grandview mine, worked by American Zinc, Lead & Smelting Co. under a profit-sharing agreement with Grandview Mines, Inc., was operated at capacity through June. A strike of the International Union of Mine, Mill and Smelter Workers forced a shutdown of the mine and mill beginning July 28 and lasting the remainder of the year. Settlement of the strike was effected in December, and operations were scheduled to be resumed early in 1955. The contract agreement reached by the company and the union included provisions for a 5-percent wage increase, retroactive pay of 5 cents per hour for the period July 1–28, and bonus pay for miners engaged in development work. Previously, only production workers had been eligible for bonus pay. The output of lead-zinc ore from the Pend Oreille Mines & Metals Co. Pend Oreille mine was somewhat less than in 1953. Owing to the more favorable price for lead during the year and the continuing depressed zinc prices, the output of lead was increased nearly one-third while zinc production was only somewhat more than half of the 1953 total. Zinc concentrate was stockpiled throughout most of the year, but shipments were resumed in October. Company efforts to improve mining efficiency through the increased use of trackless mining methods, raised to about 95 percent during the year, resulted in a decrease in the total costs per ton from $3.255 in 1953 to $3.054 in 1954. According to the company, operations were at about 50 percent of rated plant capacity during the year. The west mill remained idle during the entire 12 months, but 2 of the 800-ton units in the east mill were operated 6 days per week, with the third unit used mainly as an alternate. Mining was done on a 5-day-week basis. Completion of installation of milling facilities at the east mill raised milling capacity, including that of the west mill, to between 900,000 and 1,000,000 tons annually. Development work included drifts and raises, 827 feet; incline shaft, 508 feet; station cutting, 79,812 cubic feet; and diamond drilling, 10,256 feet. Sinking of the third section of the incline shaft was completed to 1,218 feet from the 1,600 level. Company negotiations with the International Union of Mine, Mill and Smelter Workers led in October to an agreement similar to the pattern established in the Idaho Coeur d'Alene district. The agreement called for payment of back pay of 5 cents per hour for July and August, a 5-percent wage increase retroactive to September 1 and establishment of a base rate for Pend Oreille miners of $15.56 per day. Also in the district, C. A. and C. V. Bailey produced a small quantity of lead ore from the open-pit King Tut prospect from May–July, and a quantity of lead-zinc ore was shipped from the Oriole mine near Metaline by Arthur Betchart and Edwin Dressel.

Pierce.—Contributing substantially to the economy of the county were plants in the industrialized Tacoma-Seattle area (see also King County). Metallurgical operations active during 1954 included the American Smelting & Refining Co. smelter at Ruston (Tacoma), which processed foreign and domestic materials and produced blister and refined copper as well as byproduct gold, silver, arsenic, nickel sulfate, selenium compounds, and sulfuric acid. Flue dusts containing

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valuable minor constituents also were recovered. Ferrosilicon was produced at the Ohio Ferro-Alloys Co. plant and aluminum by Kaiser Aluminum & Chemical Corp. from alumina shipped in from bauxite-refining plants in the Eastern States.

Pierce was the leading sand- and gravel-producing county in the State. Nine commercial operators contributed to the production, valued at $1.7 million, and Tacoma city engineering crews processed a small quantity of paving sand. Construction work was completed at the new plant of the Glacier Sand & Gravel Co., Steilacoom.[13] An article discussed the operation of the Pioneer Sand & Gravel Co., Steilacoom.[14] Dimension sandstone for exterior and interior construction was mined at the Wilkeson quarry by the Walker Cut Stone Co. Basalt for use as riprap and road metal was quarried by Harrison Bros. Co., Tacoma, and the Pierce River Improvement Co., Puyallup. The State highway department used basalt for roadwork. Heavy clay products were manufactured by the Builders Brick Co. from locally mined clay. The Carbonado Coal Co., the only coal producer in the county, increased production from its No. 1 mine near Carbonado.

San Juan.—Lime production by the Roche Harbor Lime & Cement Co. advanced 30 percent over the 1953 output. Since closing of the United States Gypsum Co. plant at Evans, the Roche Harbor operation has been the only lime producer in the State. The output of limestone by the company for road construction and agricultural purposes also increased. The Everett Lime Co., Seattle, operated the McGraw-Kittinger quarry near East Sound at a slightly reduced level. Paper mills were the principal consumers. A small quantity of gravel was produced by the Jensen Construction Co., East Sound.

Skagit.—Skagit County ranked second in the State in value of nonmetallic commodities. Cement was manufactured by Superior Portland Cement, Inc., at Concrete, 30 miles east of Sedro Woolley. Limestone for use at this plant and at the plant in King County was mined locally. Four commercial operators and the Great Northern Railway Co. produced sand and gravel for building and paving purposes and gravel for railroad ballast, respectively. Paving gravel also was produced by county road crews. Traprock was used by State and county highway crews. Scheel Olivine, Inc., produced a small quantity of olivine from its mine in the Twin Sisters Mountains about 17 miles north of Hamilton and soapstone from an open pit near Mount Vernon. Skagit Talc Products shipped soapstone from its operation near Marblemount; and soapstone from Dad's Girl open pit and Clear Lake Talc mine, owned and operated by Northwest Talc & Magnesium Co., was ground in the company-owned plant near Clear Lake for use in insecticides. The company did not operate the Sibley Creek mine during 1954.

Skamania.—Paving gravel was produced by the county road department. Basalt for road metal was quarried by the Broughton Lumber Co. and the county highway department.

Snohomish.—Sand and gravel valued at $796,400 was produced by 10 commercial operators; municipal, county, and State road crews; and the Great Northern Railway Co. Paving gravel was furnished

[13] Utley, H. F., Serpentine Walls Weave Unusual Pattern for Sand and Gravel Storage: Pit and Quarry, No. 6, December 1954, pp. 83–86.
[14] Lenhart, W. B., Largest Power-Scraper Installation in Sand and Gravel Industry: Rock Products, December 1954, pp. 89–92.

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to the Bureau of Public Roads. Limestone for agricultural and miscellaneous uses was mined by the Morcrop Lime Co. at its Paddock quarry and crushed at the company plant near Arlington. Miller Lime Co. operated a quarry and crusher at Gold Bar and supplied limestone for agricultural applications. Basalt was quarried by the Associated Sand & Gravel Co., Everett, and the State highway department. Breccia for use as riprap was mined by the county engineering department. The Stadium Brick & Tile Co. mined and sold clay to the Lowell Brick & Tile Co. for use in manufacturing heavy clay products. Peat was produced by two companies.

Sultan District.—Activity at the Kromona Mines Corp. Kromona mine consisted of mine development totaling more than 1,000 feet, installation of surface and mine tramming equipment, and placing in operation a new 100-ton-per-day flotation mill. Copper concentrate and some byproduct tungsten concentrate, which were stockpiled, were produced during the development.

Spokane.—Installation of fume-control systems over the last 2 of the 8 potlines at the Kaiser Aluminum & Chemical Corp. Mead aluminum-reduction plant was completed in the latter part of the year. The total cost of installing the fume-control facilities, which had been underway over 3 years, was announced as more than $5 million. Plans to increase the capacity of the company Trentwood aluminum-fabricating plant by 42 million pounds (10 percent) annually also were revealed. The expansion project, estimated to cost about $1.5 million, was to include installation of a 60-inch cold-rolling mill and a 72-inch embossing mill. Employment at the plant before the projected expansion had averaged about 2,200 persons. Ferrochrome was produced throughout the year at the Pacific Northwest Alloys, Inc., plant at Mead, except for a 6-week suspension of output early in the year due to lessened demand by the steel industry. Ferrosilicon was produced without interruption. The plant, the former Government Mead magnesium plant, was leased to the company by the Government in 1953. Completion of a contract between the company and the Government for conversion to ferrochrome of 73,000 tons of chromium concentrate stockpiled during World War II at Nye, Mont., and Coquille, Oreg., was announced.

The value of cement, sand and gravel, stone, silica, and clay, which totaled $3,336,200, placed Spokane County fifth in order of output of nonmetallic commodities. Assets of the Spokane Portland Cement Co. were acquired by the Ideal Cement Co. during the year. Included were the plant at Irvin and the Marble and Boyds quarries. The Ace Concrete Co., Dishman, placed a new crushing plant in operation. Sand and gravel valued at $1,031,092 was produced by 11 commercial operations, the Chicago, Milwaukee, St. Paul & Pacific Railroad Co., and the county highway department. Basalt for various purposes was quarried by Carbon Bros., Inland Asphalt Co., Great Northern Railway Co., and State and county road crews. Silica (vein quartz), used mainly for making ferrosilicon, was mined by the Pacific Silica Co. from the Latshaw deposit near Deer Park, north of Spokane. Heavy clay products were manufactured from clay mined by the Washington Brick & Lime Co., Gladding, McBean & Co. (Mica and Sommer pits), and Charles & Frank Pirello. Gypsum from Lake Windermere, British Columbia, was processed by the

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Columbia Gypsum Products Co., Spokane, for agricultural use and for use as a cement retarder. Vermiculite from Libby, Mont., was expanded by Vermiculite-Northwest, Inc., Spokane, for insulation purposes. Peat was produced by one company.

Field offices of the Federal Bureau of Mines and Geological Survey and the DMEA were in Spokane. Personnel from the first two agencies comprised the field teams through which property examinations and inspections were conducted in conjunction with the DMEA program of loans for minerals exploration.

Stevens.—Tungsten ores and concentrate were produced from four properties in the county during the year. Addy Development Co. produced a small quantity of tungsten from the Addy mine and shipped it to the Mineral Recovery & Engineering Co. custom mill at Osburn, Idaho. Late in the year the property was acquired under a lease and purchase option by Paul Floyd (Mineral Recovery & Engineering Co.) and Frank Birch. Before the lease, the Addy company conducted development work, consisting of drifting along the vein opened by an earlier DMEA project. At the Germania Consolidated mine work by Germania Consolidated Mines, Inc., and independent efforts by W. Traver, mine superintendent, and H. Ewing resulted in shipments of tungsten concentrate to the Salt Lake Tungsten Co. refinery at Salt Lake City, Utah, and to the Schmittroth & Etherton Big It custom mill west of Kellogg, Idaho. According to a report published during the year, work on low-grade ferberite-scheelite mineralization at the Germania Consolidated property by the Federal Bureau of Mines, Albany, Oreg., resulted in development of a successful process for making acceptable tungsten concentrates.[15] Traver & Ewing also conducted testwork on old mine dumps on the property. At the old Germania property a quantity of tungsten concentrate was produced and shipped to the GSA by Penticton Tungsten Mines, Inc., a Canadian firm. Work was begun during the summer under a lease and purchase option given by Tungsten Mining & Milling Co. Tungsten-bearing talus was milled at the rate of 100 tons per 8-hour shift. Freezing over of ponds which provided water for milling necessitated a shutdown of operations late in the year. Installation of equipment to increase mill capacity was planned. At the Big Q Tungsten Mines, Inc., Big Q property on Blue Grouse Mountain operations were resumed in the spring after a winter shutdown. The property was sold in midyear to W. H. West, who produced a small quantity of concentrate which was not shipped. Also on Blue Grouse Mountain Sunshine Mining Co. continued exploratory work on the Little King prospect. Discovery of a promising uranium prospect in the spring by two Indian brothers, John and James LeBret, on the Spokane Indian Reservation led to frenzied prospecting and claim staking in the county during the remainder of the year. By the end of the year the two brothers, with several other members of the Spokane Indian tribe, had formed Midnite Mines, Inc., and had been granted a 10-year lease on 570 acres of tribal land in the area of the discovery, 60 miles northwest of Spokane, by the Bureau of Indian Affairs. A 54-ton test shipment of ore estimated to contain about 0.35 percent U_3O_8 was made December 16 to

[15] Floyd, P. H., and Stickney, W. A., Beneficiation of Ferberite-Scheelite Ore from Germania Consolidated Mines, Inc., Stevens County, Washington: Bureau of Mines Rept. of Investigations 5039, 1954, 6 pp.

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an Atomic Energy Commission processing plant in Utah. Additional shipments were made late in the month, and diamond drilling of the deposit was begun. The uranium-bearing minerals occurring at the deposit were identified as autunite and torbernite. All activity on the reservation was under the supervision and control of the Bureau of Indian Affairs; however, considerable staking and leasing was reported throughout several thousand acres lying north and east of the reservation.

Production of magnesite by the Northwest Magnesite Co., the Nation's principal producer, decreased sharply owing to a lessening of demand by the steel industry. Output of limestone from the Limerock quarry was slightly greater than in 1953. The quarry and crusher at Marble were sold to the Ideal Cement Co. by the Spokane Portland Cement Co. in September 1954. The stone was used in manufacturing cement, at papermills, and as a fertilizer filler. Peter Janni & Sons operated the Janni quarry and plant at about the 1953 rate. Limestone was sold principally for metallurgical and chemical applications; a small quantity went into stucco and roofing materials. The Manufacturers Mineral Co., Seattle, produced terrazzo chips from marble mined at the June Echo, Parks Red, Valley White, and Cottman Black quarries. Structural clay products were manufactured by the Washington Brick & Lime Co. Paving sand and gravel and railroad ballast were processed by the Great Northern Railway Co. and municipal and State road crews. Grinding pebbles and crushed and ground silica-sand products were processed by the Mineral Products Corp., Seattle, from its Chewelah pit. The pebbles were used for tube-mill grinding purposes by the Manufacturers Mineral Co. A quartzite deposit west of Colville was investigated by the Bristol Silica Co., Grants Pass, Oreg.

Bossburg (Clugston Creek) District.—The Bonanza Lead Co. produced a quantity of copper ore from the Copper Mountain mine, and a small quantity of lead ore was shipped from the Clugston Creek mine, operated under lease by Williams & McKnight from September 20 to December 15. Chewelah Copper Co. conducted development work at the old United Copper properties during the year.

Northport (Aladdin) District.—Operations at the Goldfield Consolidated Mines Co. Deep Creek mine, halted since October 31, 1953, because of low lead-zinc prices, were resumed on a limited basis in May after a partial recovery of the lead-zinc market. According to the company annual report, production totaled 3,893 tons of concentrate compared with 9,655 tons in 1953. The open-pit Van Stone zinc mine was worked throughout the year by American Smelting & Refining Co. Operations were reportedly on a marginal basis in the latter part of the year following completion of the company contract with the Government for production of the metal at a floor price of 15½ cents per pound. Production under the contract was begun in 1952. Reports indicated that in December the mill was processing about 30,000 tons of ore per month, an equal quantity of waste and overburden being stripped from the deposit. A. C. Nieman produced a quantity of lead-zinc ore from the Admiral and Red Top mines and from the Lead Trust mine in November and December; the ore was treated at the Admiral mill. The Lead Trust mine was worked by F. J. Cardinal during the year until the lease on the property expired

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October 20. Small quantities of lead ore were produced by Harris & Bumgarner from the Electric Point mine, by Gladstone Mountain Mining Co. from the Gladstone mine, and by Godfrey, Godfrey & Yocum from the Lead King open-pit mine. Lead-zinc ore was produced from the Last Chance mine by Last Chance Consolidated Mines, Inc., during development work. Alpine Uranium Corp. began a large-scale rehabilitation program at the Turk and Deer Trail mines near Fruitland in the latter part of the year. Expansion of milling capacity to 125 tons per day was undertaken, and a road was built between the Turk mine and the mill on the Deer Trail property. New mill machinery included crushing and grinding equipment, a classifier, flotation cells, and a concentrate drier. Mining and milling operations were begun shortly before the end of the year, but no shipments were reported for 1954. The old Togo mine, which adjoins the Turk mine, also was being developed under lease by Harvey Gray.

Old Dominion District.—Pioneer Mining Co. produced lead ore containing recoverable zinc and silver from the Longshot mine.

Thurston.—Gravel for roadwork was mined by the county highway department. The only new coal-mining operation in the State during 1954 was that of the Stoker Coal Co., which began working the Tono No. 1 mine in September. The mine formerly was operated by Strain Coal Co. Peat was produced by three companies.

Walla Walla.—Building sand and gravel and paving gravel were produced by the Jones-Scott Co. and county road crews, respectively. County highway crews quarried traprock for roadwork.

Whatcom.—Olympic Portland Cement Co., Ltd., Bellingham, was 1 of 2 cement plants in the State showing increased production during 1954. Limestone and clay used in manufacturing cement were mined by the company. Coal production by Bellingham Coal Mines Co. decreased below the 1953 output. Three commercial operators and State, county, and municipal agencies produced sand and gravel valued at $226,400. The limestone output from the Maple Faces quarry of the Mitchell Bay Lime Co., Seattle, was slightly greater than 1953. The product was used at paper mills. The Olympic Portland Cement Co. mined limestone for use in manufacturing cement at the Kendall quarry, Maple Falls. Basalt for road metal was prepared by the State highway department.

Whitman.—Stone for use as riprap and road metal was produced by the Union Pacific Railroad Co. and county highway crews, respectively. Sand and gravel was produced by Don R. Ross and the Chicago, Milwaukee, St. Paul & Pacific Railroad Co. and for the State highway department by contractors.

Yakima.—Sand and gravel, stone, and clay valued at $830,000 were produced in the county. Eleven commercial sand and gravel operators processed material for construction and road building. State and county highway crews quarried basalt for riprap and road metal. Structural clay products were manufactured from locally mined clay by the Granger Clay Products Co. The Yakima Cement Products Co. marketed masonry building block and hollow-core concrete products under the trade name "Trulay."

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The Mineral Industry of West Virginia

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the West Virginia Geological Survey.

By James R. Kerr [1] and Jean Pendleton [2]

BECAUSE the mineral output of West Virginia consists primarily of coal production, any change therein during the year obviously affects the State total. This was the case in 1954, when a 14-percent drop in bituminous-coal output resulted in a 12-percent drop in total mineral production of the State. Lower coal production not only reflected continued instability in coal-marketing conditions but also the effects of competition from oil and natural gas.

In addition to the sharp decrease in coal production, clay and lime output dropped 39 and 22 percent, respectively, below 1953. The production of natural-gas liquids, petroleum, natural salines, recovered elemental sulfur, and calcareous marl decreased slightly, compared with the preceding year; however, the output of stone, sand and gravel, salt, natural gas, bromine, and cement increased.

TABLE 1.—Mineral production in West Virginia, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	968,838	$2,488,938	587,120	$1,450,539
Coal	134,105,310	693,593,645	115,996,041	541,369,652
Natural gas, million cubic feet	186,477	44,009,000	191,601	45,601,000
Natural-gas liquids:				
Natural gasoline, thousand gallons	44,352	3,245,000	41,076	2,593,000
LP-gases, do	153,090	6,743,000	142,884	5,035,000
Petroleum (crude), thousand 42-gallon barrels	3,038	11,570,000	2,902	8,500,000
Salt (common)	419,907	1,490,592	471,516	2,885,696
Sand and gravel	3,162,776	6,070,847	4,073,991	8,351,153
Stone	[2] 5,501,148	[2] 8,924,411	7,314,934	11,743,440
Undistributed: Abrasive stones (1953), bromine, calcium-magnesium chloride, cement, lime, calcareous marl, stone (dimension limestone, 1953), ground sand and sandstone (1953), and recovered elemental sulfur (1954)		11,974,948		10,504,113
Total West Virginia		790,110,000		[3] 636,311,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes limestone used in the manufacture of lime and cement.
[3] The total has been adjusted to eliminate duplication in the value of clays and stone.

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REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Even though coal production dropped 14 percent below 1953, West Virginia, for the 23rd consecutive year, maintained its position as leading bituminous-coal producer in the United States. One hundred and seventeen coal beds, primarily of Pennsylvanian age, have been identified in the State; 61 have been proved minable. Forty-four of the State's 55 counties are underlain by coal; 36 produced coal in 1954. More intensive folding of coal-bearing strata occurs in the eastern section of the State, where less volatile coals are found. The western section contains predominantly coals of lesser rank. Owing to the predominating rugged terrain, strip mining had no primary importance, constituting only 6 percent of the State total (auger mining 1 percent). Larger producing counties, in order of decreasing value, were McDowell, Logan, Marion, Wyoming, Kanawha, Raleigh, Harrison, Monongalia, and Nicholas. Larger producing mines included Pocahontas Fuel Co. Itmann Colliery, Wyoming County; United States Steel Corp. No. 2 mine, McDowell County; Bethlehem Mines Corp. No. 44, Marion County; and Christopher Coal Co. Arkwright No. 1 and Osage No. 3, both in Monongalia County.

Layoffs, mine shutdowns, and a 3-day work week reflected the poor market for coal in 1954. Mines producing coal for the captive market were not operating near capacity.

On the brighter side of the picture, depicting confidence in the future prominence of coal, was the development by the A. T. Massie Co. of a virtually untapped field of high-grade Sewell and Fire Creek coal in Fayette County. Three mines are being developed to produce an estimated 4,000 tons daily. A cleaning plant to serve the mines was being erected near Clifftop, W. Va.

Late in the year construction of a $100,000 plant was begun at Ceredo, Wayne County, designed to process refuse from the Ceredo coal-preparation plant for use as aggregate. This plant, the first of its kind in the United States, was being built by the Truelite Corp., operating under a lease agreement with Truax-Traer Coal Co., owner of the preparation plant. The operation will initially produce 40,000 tons of aggregate a year, with plans for later expansion to 150,000 tons. Charles N. Howard, president of the Truelite Corp., developed the process in cooperation with the Federal Bureau of Mines.

During the year the West Virginia Supreme Court upheld a lower court decision against strip mining on the State forest property.

TABLE 2.—Coal production, 1945–49 (average) and 1950–54

Year	Short tons	Value	Value per ton	Year	Short tons	Value	Value per ton
1945–49 (average)	152, 736, 745	$676, 892, 903	$4. 43	1952	141, 713, 059	$741, 421, 131	$5. 23
1950	144, 115, 683	754, 370, 245	5. 23	1953	134, 105, 310	693, 593, 645	5. 17
1951	163, 309, 822	853, 893, 679	5. 23	1954	115, 996, 041	541, 369, 652	4. 67

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Petroleum and Natural Gas.—West Virginia's natural gas occurs in various horizons throughout the western half of the State. Thirty-nine counties yielded important quantities of this natural resource. Potential new areas were being sought in the northern and eastern part of the State. Commercial gas was being proved on the eastern side in the more strongly folded areas. Natural gas and petroleum ranked second and fourth, respectively, in value among the mineral industries of West Virginia in 1954. The value of natural-gas production increased 4 percent over that in the previous year; petroleum decreased 27 percent. As of December 31, 1954, proved estimated recoverable reserves were 37 million barrels of crude oil. Proved reserves of natural gas were estimated to be 1,607 billion cubic feet in 1954.[3]

Of the 614 wells drilled in 1954, 427 produced gas and 67 oil; 120 were dry holes. The depth of drilling ranged from under 2,500 feet to 10,000. No wells over 10,000 feet deep were drilled; however, drilling passed the 8,200-foot mark on a wildcat test for Hope Natural Gas Co. in Wood County, 16 miles east of Parkersburg. This well is expected to become the deepest well drilled in the State and to surpass another Hope test drilled to 10,018 feet in 1941.

Sixty-six percent of the natural gas was produced from the following counties: Logan, Kanawha, Calhoun, Mingo, Wyoming, Randolph, and Lincoln, in decreasing order of value. The major oil-producing counties were Jackson, Calhoun, Roane, Ritchie, Wirt, and Wayne, which produced 91 percent of the State total.[4]

New developments were made primarily in the Oriskany sand and the "Brown shales" (Devonian shales). Hydraulic fracture of producing sands met with fine success. Flooding operations were begun at several points in the State during the year, and extensive studies were conducted on the feasibility of flooding many West Virginia fields.

NONMETALS

Cement.—The production of cement in West Virginia in 1954 rose 3 percent, compared with 1953. Standard Lime & Stone Co., Martinsburg, Berkeley County, and the Alpha Portland Cement Co., Manheim, Preston County, were the producers. Local limestones, shales, and sands were utilized as raw material by both companies.

Clays.—Production of fire clay, which composed 49 percent of the tonnage and 81 percent of the value of clays produced in 1954, was concentrated primarily in Hancock and Kanawha Counties. The major producers were Globe Brick Co. (Newell) and Crescent Brick Co., Inc., and West Virginia Fire Clay Mfg. Co. (New Cumberland), Hancock County; and West Virginia Brick Co., Charleston, Kanawha County. Fire clay was used predominantly in manufacturing heavy clay products (building and paving brick, drain tile, etc.), firebrick and block, and mortar.

Miscellaneous clay, which composed 51 percent of the tonnage but only 19 percent of the value, was obtained mainly in Berkeley and Cabell Counties. As in the previous year, the two major producers

[3] American Petroleum Institute, American Gas Association Reserves Committee Report Dec. 31, 1954.
[4] Tucker, R. C., Oil and Gas Developments in West Virginia in 1954: Bull. Amer. Assoc. Pet. Geol., vol. 39, No. 6, June 1955, pp. 831–836.

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were United Clay Products Co., North Mountain, and Continental Clay Products Co., Martinsburg, both in Berkeley County. Barboursville Clay Mfg. Co., Barboursville, Cabell County, also reported production in 1954.

TABLE 3.—Clays sold or used by producers, 1945–49 (average) and 1950–54

Year	Fire clay		Miscellaneous clay		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945–49 (average)	270,398	$803,780	240,159	$177,660	510,557	$981,440
1950	309,100	735,285	366,001	269,135	675,101	1,004,420
1951	732,492	1,923,872	371,154	371,154	1,103,646	2,295,026
1952	621,996	2,072,688	360,034	348,981	982,030	2,421,669
1953	677,005	2,213,376	291,833	275,562	968,838	2,488,938
1954	290,256	1,171,495	296,864	279,044	587,120	1,450,539

Lime.—The lime produced in West Virginia in 1954 was used primarily as a refractory (54 percent), as a flux in manufacturing steel (32 percent), and for agricultural, building, and chemical uses (14 percent). Production was centered in Jefferson and Berkeley Counties. Standard Lime & Stone Co. and Jones & Laughlin Steel Corp. were the larger producers. The bulk of the output was consumed in Pennsylvania and Maryland.

Magnesium Compounds.—Standard Lime & Stone Co. produced refractory magnesia from raw dolomite at its Millville plant, Jefferson County.

Marl (Calcareous).—Calcareous marl was produced from a pit near Charles Town, Jefferson County, by West Virginia Lime Co. for use as soil conditioner.

Natural Salines.—Westvaco Chemical Division, Food Machinery & Chemical Corp., Kanawha County, reported output of calcium-magnesium chloride and bromine and bromides as byproducts of brine produced from wells near South Charleston.

Salt.—The salt industry was among the early important industries in West Virginia, especially in the Kanawha Valley. At least 27 counties in the State are underlain by salt-bearing formations. Of these, only Kanawha, Marshall, and Mason were active in 1954. Producers were Columbia Southern Chemical Corp., Natrium, Marshall County; Westvaco Chlor-Alkali Division, Food Machinery & Chemical Corp., South Charleston, Kanawha County; Solvay Process Division, Allied Chemical & Dye Corp., Moundsville, Marshall County; and Liverpool Salt Co., Hartford, Mason County.

Sand and Gravel.—Sand and gravel operations in West Virginia in 1954 consisted almost entirely of dredging on the State Rivers. Of the 29 reporting companies, 23 mentioned river operations. Production increased 29 percent, compared with 1953. Leading counties of the 17 reporting output were Morgan, Hancock, Cabell, Brooke, and Wood. Larger producing companies, in order of decreasing value, were Pennsylvania Glass Sand Corp., Morgan County; Dravo Corp., Keystone Division, Hancock County; Ohio River Sand & Gravel Corp., with operations in Tyler and Wood Counties; Duquesne Sand Co., Brooke County; Pfaff & Smith Builders Supply Co., Kanawha County; and Ohio River Dredging Co., Cabell County.

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TABLE 4.—Sand and gravel sold or used by producers, 1953–54, by uses

Use	1953		1954	
	Short tons	Value	Short tons	Value
Sand:				
Glass	1,152,776	$3,357,367	(1)	(1)
Building	447,163	632,302	678,829	$904,038
Paving	326,012	329,677	660,624	709,287
Engine	152,887	288,179	157,771	292,833
Gravel:				
Building	410,808	528,674	635,651	781,411
Paving	351,502	352,274	613,441	669,631
Railroad ballast	(1)	(1)	26,142	25,777
Undistributed [2]	321,628	582,374	1,301,533	4,968,176
Total	3,162,776	6,070,847	4,073,991	8,351,153

[1] Figure withheld to avoid disclosure of individual company operations; included with "Undistributed."
[2] Includes molding sand, grinding and polishing sand, railroad ballast, and other.

Stone.—Both limestone and sandstone were quarried in West Virginia in 1954; limestone was the more important commodity, comprising 80 percent of the stone total. Large and valuable deposits of limestone and sandstone occur in the State, where some 40,000 feet of sedimentary rocks is exposed. Limestone was obtained from 19 quarries in 10 counties; sandstone was obtained from 2 quarries in 1 county. The larger limestone-producing counties were Jefferson, Berkeley, and Greenbrier. Major companies were Jones & Laughlin Steel Corp., Blair Limestone Division, in Jefferson and Berkeley Counties; Standard Lime & Stone Co., also in Jefferson and Berkeley Counties; Michigan Limestone Division, United States Steel Corp., Jefferson County; and Acme Limestone Co., Greenbrier County. Major uses for the product were for blast-furnace flux and as a concrete aggregate and roadstone.

Sandstone producers were Lambert Bros., Inc., and Grandview Sand Co., both of Raleigh County.

TABLE 5.—Crushed and broken stone sold or used by producers, 1953–54, by uses

Use	1953		1954	
	Short tons	Value	Short tons	Value
Flux (limestone)	3,689,511	$5,960,661	2,419,318	$3,934,239
Concrete and roadstone	1,136,539	1,843,686	2,940,453	4,850,253
Railroad ballast	420,781	542,187	485,979	575,647
Agriculture (limestone)	49,410	95,910	94,028	241,603
Other [1]	204,907	481,967	164,995	499,443
Undistributed [2]			1,210,161	1,642,255
Total	5,501,148	8,924,411	7,314,934	11,743,440

[1] Limestone for miscellaneous uses.
[2] Includes limestone for cement and lime, ground sandstone, and refractory stone.

REVIEW BY COUNTIES [5]

Barbour.—The leading producers of bituminous coal—the only mineral produced in the county in 1954—were Compass Coal Co. Nos. 1, 2, and 3 mines, Galloway No. 3 mine of Simpson Coal &

[5] Excludes petroleum, natural gas and natural-gas liquids. County data for these commodities are not available.

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Chemical Corp., Bethlehem Mines Corp. Century 101, and Mountain Fuel Co. Glen Cambria mine. The strip pits of Grafton Coal Co. and Freeport Gas Coal Co. yielded the bulk of strip tonnage in 1954.

Berkeley.—Berkeley County was the major cement-producing area in the State, with total county production from Standard Lime & Stone Co. operations at Martinsburg.

This county was also the largest producing area for limestone, which was used predominantly for blast-furnace flux. Major producers were Blair Limestone Division of Jones & Laughlin Steel Corp., and Standard Lime & Stone Co., both of Martinsburg. Other producers in the county were the J. E. Baker Co., Inwood, and W. S. Frey Co., Martinsburg. Burnt lime for chemical, agricultural, and

TABLE 6.—Value of mineral production in West Virginia, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value [2]
Barbour	$13,809,588	$11,968,108	Coal.
Berkeley	8,975,345	(3)	Cement, stone, lime, clays.
Boone	28,497,497	26,371,760	Coal.
Braxton	356,730	187,394	Do.
Brooke	(3)	(3)	Coal, sand and gravel.
Cabell	(3)	(3)	Sand and gravel, clays.
Clay	4,310,059	(3)	Coal.
Fayette	(3)	(3)	Coal, sand and gravel.
Gilmer	175,140	205,422	Coal.
Grant	[4] 232,000	349,444	Coal, stone.
Greenbrier	[4] 7,529,000	6,638,122	Do.
Hancock	2,294,211	(3)	Clays, sand and gravel, coal.
Hardy		31,000	Stone.
Harrison	[4] 34,247,000	27,300,166	Coal.
Jackson	(3)	(3)	Sand and gravel.
Jefferson	6,172,038	(3)	Stone, lime, calcareous marl.
Kanawha	50,876,814	38,211,651	Coal, salt, bromine, sand and gravel, clays, calcium chloride, recovered sulfur.
Lewis	[4] 816,000	1,957,993	Coal, clays.
Lincoln	(3)	(3)	Coal, sand and gravel.
Logan	82,683,929	66,578,618	Coal.
Marion	[4] 55,303,000	41,458,329	Do.
Marshall	[4] 1,990,000	(3)	Coal, salt.
Mason	[4] 2,118,000	684,900	Coal, salt, sand and gravel.
McDowell	113,296,150	92,771,783	Coal.
Mercer	14,069,371	7,274,340	Coal, stone, clays.
Mineral	196,446	277,913	Coal.
Mingo	34,018,152	(3)	Coal, sand and gravel.
Monongalia	[4] 36,714,000	28,973,266	Coal, stone, sand and gravel, recovered sulfur.
Morgan	4,571,731	(3)	Sand and gravel.
Nicholas	(3)	(3)	Coal, sand and gravel.
Ohio	(3)	(3)	Do.
Pocahontas	2,640,964	1,575,064	Coal.
Preston	9,812,389	8,840,689	Coal, cement.
Putnam	120,246	507,794	Coal, stone.
Raleigh	(3)	(3)	Coal, stone, sand and gravel.
Randolph	[4] 8,415,000	5,626,811	Coal, stone.
Summers	(3)	(3)	Coal.
Taylor	(3)	(3)	Coal, clays.
Tucker	1,011,478	484,930	Coal.
Tyler		(3)	Sand and gravel.
Upshur	(3)	(3)	Coal, clays.
Wayne	(3)	(3)	Coal, sand and gravel.
Webster	6,123,888	3,282,167	Coal.
Wetzel	(3)	278,276	Sand and gravel.
Wood	(3)	224,484	Do.
Wyoming	48,807,248	(3)	Coal, sand and gravel.
Undistributed	209,926,586	264,250,491	
Total	790,110,000	636,311,000	

[1] The following counties were not listed, because no tonnage was reported: Calhoun, Doddridge, Hampshire, Monroe, Pendleton, Pleasants, Ritchie, Roane, and Wirt.
[2] Fuels (including natural gas, natural gas liquids and petroleum) included with "Undistributed."
[3] Value included with "Undistributed."
[4] Value of coal only.

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building purposes was also produced by the Jones & Laughlin Steel Corp. and the Standard Lime & Stone Co.

Berkeley County was one of the main sources of miscellaneous clay for use in manufacturing heavy clay products, as the United Clay Products Co., North Mountain, and Continental Clay Products Co., Martinsburg, reported production in 1954.

Boone.—Coal was the only mineral commodity produced in Boone County, which ranked 11th among 36 coal-producing counties in 1954. Major producers were Eastern Gas & Fuel Associates Nos. 1 and 2 mines; Youghiogheny & Ohio Coal Co. Van mine; and the Nos. 1, 2, and 5 underground mines and the auger mine of Red Parrot Coal Co., Division of North American Coal & Dock Co.; Princess Dorothy Coal Co. Robin Hood No. 6 mine, Glogora Coal Co., Inc., Blue Pennant mines, Armco Steel Corp. Nellis No. 3 mine, Westmoreland Coal Co. Hampton mine, and Anchor Coal Co. Nos. 8, 9, and 10 mines.

Braxton.—A small quantity of coal was produced in Braxton County. The No. 2 mine of Kuhl Coal Co., Bower, was the leading producer. Other producers in the county were Ideal Coal Co. No. 1 mine, Exchange Coal Co. Nos. 1 and 2 mines, Burnsville Coal Co. Marks and Burke mines, and R. & S. Coal Co. No. 1 mine. The entire county output was from underground operations.

Brooke.—Bituminous coal and sand and gravel were mined in Brooke County in 1954. The largest underground coal producer was Windsor Power House Coal Co. Beech Bottom mine, which produced more than 50 percent of the county coal output. Other underground producers included Beech Bottom Coal Co. and Liberty Colliery, Inc. The leading strip-mine producers were K & P Construction Co. and West Virginia Pittsburgh Coal Co. Other strip producers are Penowa Coal Co., East Pike Coal Co., and Taylor & Hercules Coal Co.

Of the 21 counties producing sand and gravel, Brooke County ranked third, with Duquesne Sand Co., Wellsburg, supplying the entire county output, which was utilized for highway paving.

Cabell.—Cabell County was the second leading area in the production of sand and gravel in the State in 1954. The output was used predominantly for building sand and paving and road material. The county producers were Ohio River Dredging Co. dredge operation on the Ohio River near Glenwood and Union Sand & Gravel Co. floating dredge near Huntington. Miscellaneous clay for manufacturing heavy clay products was mined by Barboursville Clay Mfg. Co., Barboursville, and West Virginia Paving & Pressed Brick Co., Huntington.

Clay.—The only mineral product in Clay County in 1954 was coal, all from underground mines. Elk River Coal & Lumber Co. was by far the major producer. The balance of the county tonnage was mined from the Lemoyne No. 2 mine of Chemical Coal Co., Orchard Fork mine of the Hickman Lumber Co., and the No. 3 mine of Osborne Bros. Coal Co.

Fayette.—Coal was the principal commodity produced in Fayette County in 1954; the county ranked 10th among 36 coal-producing counties. Strip-mined coal made up a little less than 1 percent of the county output. Major coal producers were the New River Co.,

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New River & Pocahontas Construction Coal Co., Semet-Solvay Division, Allied Chemical & Dye Corp., Eastern Gas & Fuel Associates, Ames Mining Co., Milburn By-products Coal Co., Electro Metallurgical Co., Southern Coal Corp., Royalty Smokeless Coal Co., and Gauley Mt. Coal Co. The A. T. Massie Co. began developing three mines in a virtually untapped field of high-grade Sewell and Fire Creek coal on the headwaters of Manns and Glade Creeks. It was anticipated that 4,000 tons per day would be mined.

Glass sand was produced by Sun Sand Co. from a pit near Thayer.

Gilmer.—Bituminous coal from underground and strip operations was the only mineral produced in Gilmer County in 1954. The leading producers were Glenville Coal Co. Nos. 2 and 3 mines, G. & L. Coal Co. No. 2 mine, Post Coal Co. Duck Run No. 1, and Johnson Coal Co., Inc., strip mines near New Martinsville.

Grant.—The output of limestone was reported by Oscar Keplinger, Maysville, in 1954 for agricultural uses.

Bituminous coal was mined predominantly by Stoney River Coal Co., Hazel 'O Co., and Mount Storm Coal Co. Other producers include M. R. Kuhn Coal Co., Abernathy Coal Co., and Taylor Coal Co.

Greenbrier.—Greenbrier was the third largest limestone-producing county in the State in 1954. The leading producers were Acme Limestone Co. and H. Frazier Co., Inc., both of Fort Spring. H. B. and H. H. Fullen, Lewisburg, also produced limestone. County output was used for concrete and roadstone, railroad ballast, and agricultural and chemical uses.

Bituminous coal was also mined. The bulk of the tonnage was produced by the Left Fork Fuel Co., Inc., and the Raine Lumber Coal Co. Coal was also mined at Burn-Rite Coal Co. strip pits, Lafayette Springs Coal Co. underground and strip operations, Imperial Coal & Construction Co. strip mines, Wilpen Coal Co. No. 2 mine, Thermal Fuel Co. No. 13 mine, Midland Coal Co. No. 1 mine, and Beech Knob Coal Co.

Hancock.—In terms of value, clay was the most important mineral produced in Hancock County, with sand and gravel and coal in second and third place, respectively. The county ranked first in the State in both clay and sand and gravel production in 1954.

The leading fire-clay producer was Globe Brick Co., Newell. Crescent Brick Co., Inc., and West Virginia Fire Clay Mfg. Co., both of New Cumberland also produced fire clay. Output was utilized for firebrick and block and refractories (mortar).

Leading sand and gravel operations were the Nos. 8 and 9 dredge mines of Dravo Corp. Keystone Division, which yielded the bulk of the county output. The Iron City Sand & Gravel Corp. also reported considerable tonnage. The county output was used mainly for building and paving purposes.

The A. A. A. L. W. Mining Corp., Weirton, reported production of coal from its No. 4 underground mine.

Hardy.—The only mineral produced in Hardy County was limestone from the open quarry of Beans Lime Stone, Inc., Moorefield. The output was used for roads, paving, and agricultural purposes.

Harrison.—Bituminous coal was the only mineral produced in Harrison County in 1954; the county ranked seventh in State coal

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production. The county strip mines contributed a considerable tonnage of coal and reported about one-fourth of West Virginia's strip production. By far the larger operations were Consolidation Coal Co. No. 32 and Williams mines. Other producers were Compass Coal Co. Nos. 1, 2, and 4 mines, Barnes-Dawson Coal Co. Dawson mine, the strip mines of B. H. Swaney, Inc., Coal River Mining Co. strip mines, L. E. Cleghorn strip mines, Robey Run Coal Co. underground Ruby mine, Bethlehem Fairmont Coal Co. Scott No. 2 underground mine, Keeley Construction Co. strip mines and Yochym Bros. Coal Co. strip mines.

Jackson.—Ravenswood Sand & Gravel Co., Inc., reported output of sand and gravel from its pit near North Ravenswood.

Kaiser Aluminum & Chemical Corp. announced in August of 1954 that two fabricating plants for producing aluminum welded tubing will be built at Ravenswood on the Ohio River.

Jefferson.—Jefferson County ranked second as a limestone-producing area in West Virginia. The bulk of the total county production was used for blast-furnace flux. It was also used in concrete and roadstone, and for chemical and agricultural purposes. County producers were Michigan Limestone Division, United States Steel Corp., Millville; Jones & Laughlin Steel Corp., Blair Limestone Division, Harpers Ferry; Standard Lime & Stone Co., with plants in Engle and Millville. Jones & Laughlin Steel Corp. and Standard Lime & Stone Co. produced quick and hydrated limes, predominantly for refractory use and in the manufacture of steel. Refractory magnesia, made from raw dolomite, was also produced by Standard Lime & Stone Co. Calcareous marl was mined by West Virginia Lime Co. from its pit near Charles Town. The entire output was used for agricultural purposes.

Kanawha.—Kanawha County produced coal, natural salines, clay, salt, and sand and gravel in 1954. The county ranked fifth in coal output. The leading producers of coal, in order of decreasing output, were Truax-Traer Coal Co., Valley Camp Coal Co., Carbon Fuel Co., Amherst Coal Co., Cannelton Coal & Coke Co., Imperial Colliery Co., The Warner Collieries Co., Central Appalachian Coal Co., Fields Creek Coal Co., and Winifrede Collieries.

The only producer of salt and natural salines in the county was Westvaco Chlor-Alkali Division, Food Machinery & Chemical Corp., South Charleston. The output was used almost entirely for chlorine and bleaches.

Fire clay was mined by West Virginia Brick Co., Charleston, and Charleston Clay Products Co., Barlow Station. The entire county output was used for heavy clay products, which include building brick, drain tile, and sewer pipe.

Sand and gravel production was reported by four companies. Pfaff & Smith Builders Supply Co., Charleston, was the largest producer. Other producers were St. Albans Sand Co., St. Albans; Zenith Sand Co., Inc., Alum Creek; and Charleston Sand Corp., Charleston. All operations were on the Coal River.

Lewis.—The bulk of the coal mined in Lewis County was stripped from mines of Bitner Fuel Co. and Yochym Bros. Coal Co. Other producers included L. E. Cleghorn and Scott Coal Co.

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Clay was produced by Weston Brick & Coal Co., Weston, and Jane Lew Brick & Tile Co., Jane Lew, from open-pit mines for use in manufacturing heavy clay products, such as building brick, tile, sewer pipe, etc.

Lincoln.—Engine sand was produced in Lincoln County by Davis & Adkins Sand Co. and Dean Coal & Sand Co., both of Ferrellsburg. Sand for railroad ballast and coal were dredged from the Guyandot River near Midkiff by the Guyan River Co. Hal H. Dial & Son also dredged for coal and sand from this river near Branchland.

Logan.—Logan County ranked second in coal production in West Virginia in 1954. Larger companies, all with production over 1 million tons, were Guyan Eagle Coal Co., Island Creek Coal Co., Amherst Coal Co., Powellton Coal Co., and West Virginia Coal & Coke Corp. At the end of the year West Virginia Coal & Coke Corp. sold its coal mines to Omar Mining Co. The company reported that, although it will not actively be engaged in mining, it will continue its river-transportation business. Other large coal producers were Lorado Coal Mining Co., Boone County Coal Corp., Youngstown Mines Corp., Jewell Ridge Coal Co., and Jewell Eagle Coal Co.

Marion.—Bituminous coal was the only mineral produced in Marion County, which reported the third largest coal-production in the State. Larger producing mines were Bethlehem Mines Corp.'s Nos. 41 and 44 mines, the Federal No. 1 mine of Eastern Gas & Fuel Associates, Consolidation Coal Co. Nos. 63, 93, and 97 mines, Jamison Coal & Coke Co. Jamison No. 9, Rochester & Pittsburgh Coal Co. O'Donnell mine, and Joanne Coal Co. Joanne mine. The number of mines in the county was relatively small, but most companies produced large tonnages.

Marshall.—Columbia Southern Chemical Corp. at Natrium and Solvay Process Division of Allied Chemical & Dye Corp., Moundsville, produced brine from wells in Marshall County in 1954. Output was utilized for chlorine, bleaches, and chlorides.

Coal was produced by Valley Camp Coal Co. Alexander mine at Elm Grove.

Mason.—Liverpool Salt Co. produced evaporated salt by the open-pan method at its Hartford plant. The output was used for tanning, meat packing, livestock feeding, water softening, and table salt.

Bituminous coal was produced from underground operations by a group of small producers. The larger were Lieving Coal Co. and Orchard Coal Corp. Other producers were Hudson Bros. Coal Co. and Kentucky Fuel Co. One strip operation was operated in 1954 by Swisher Coal Co.

Sand and gravel was mined by the Letart Sand & Gravel Co., Letart, from a river-bank operation.

McDowell.—In 1954 McDowell County remained the leading producer of bituminous coal in West Virginia. The bulk of the output was obtained from underground operations, although a few companies reported strip- and auger-mining production. Major producing mines, in descending value, were United States Steel Corp. No. 2 mine, Gary; Pond Creek Pocahontas Co. No. 1 mine, Bartley; Eastern Gas & Fuel Associates Keystone mine, Keystone; United States Steel Corp. Nos. 6, 14, and 10 mines, Gary; Olga Coal

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Co. No. 1 mine, Coalwood; Pond Creek Pocahontas Co. No. 6 mine, Bartley; and United States Steel Corp. No. 9 mine, Gary.

Eastern Gas & Fuel Associates announced it had permanently abandoned the Carsweel and Martland mines.

Mercer.—Bituminous coal, clay, and limestone were mined in Mercer County in 1954. Coal was mined by auger, strip, and underground methods, but the bulk of the total came from underground mines. The major producing companies were American Coal Co., Crozer Coal & Land Co., Pocahontas Fuel Co., Inc., Winding Gulf Collieries, and the Weyanoke Coal & Coke Co. The largest strip-mining company was American Coal Co. of Allegany County, McComas, W. Va.

Miscellaneous clay for use in manufacturing heavy clay products was produced by the Virginian Brick & Tile Co. from an open-pit mine near Princeton.

Crushed limestone for use in making concrete and as roadstone was reported from two operators. Brown & Wright reported production from an open quarry and a portable plant near Montcalm, and Bluefield Limestone Co. operated an open quarry and crusher at Bluefield.

Mineral.—The sole mineral produced in Mineral County in 1954 was bituminous coal mined by Pine Swamp Mining Co., Harding Coal Co., and Wabash Coal Co., all from underground operations.

Mingo.—By far the most important mineral commodity produced in Mingo County in 1954 was bituminous coal, the bulk of which was obtained from underground operations. The largest producer was the Island Creek Coal Co., with its Nos. 24, 25, 26, and 27 operations. Other large producers included Red Jacket Coal Corp., Gay Mining Co., Ames Coal Co., Puritan Coal Corp., Sycamore Coal Co., Peter White Coal Co., and Burning Springs Colliery Co.

Sand and gravel was produced by the Rock Castle Sand Co., Kermit, and Guyan Valley Sand Co., Gilbert, from river-dredge operations.

Monongalia.—Bituminous coal, limestone, and sand, in order of decreasing value, were mineral commodities produced in 1954. By far the most important coal producer was the Christopher Coal Co., Pursglove, with its Arkwright No. 1, Osage No. 3, and Pursglove No. 15 mines. Other large coal producers included the Valley Camp Coal Co., Trotter Coal Co., South Union Coal Co., Locksley Fuel Corp., and Rosedale Coal Co., and Lockview Coal Co. The county ranked 9th among 36 coal-producing counties in 1954.

Crushed limestone, produced primarily for use in making concrete and as a roadstone, was quarried by the Vesco Corp., Lake Lynn, and Greer Limestone Co., Greer. The only sand producer was Deckers Creek Sand Co., Greer, which reduced rock into industrial sand.

Morgan.—The Pennsylvania Glass Sand Corp., at a quarry and plant north of Berkeley Springs mined, crushed, and sized the Oriskany sandstone. The product obtained was utilized as glass, molding, building, paving, and engine sand and for cleansing and scouring compounds.

Nicholas.—Bituminous coal was the only mineral produced in 1954. Most of the mines were underground operations, but considerable tonnage was mined from the few strip pits in the county. Major

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underground coal producers were Peters Creek Coal. Co., Imperial Smokeless Coal Co., Johnstown Coal & Coke Co., Panther Coal Co. of West Virginia, Tioga Coal Corp., Mount Hope Coal Co., and Richwood Sewell Coal Co. Larger strip operations were Gauley Eagle Coal & Coke Co. and Coal River Mining Co.

Ohio.—Bituminous coal and sand and gravel were produced in Ohio County in 1954. Valley Camp Coal Co. produced the major portion of the county coal total. The Dependable Coal Co. and Costanzo Coal Mining were the other producers. H. L. Seabright Co. dredged sand and gravel from the Ohio River near Wheeling for building purposes.

Pocahontas.—Coal mined by the Maust Coal & Coke Co. from an underground mine was the only commodity produced in 1954.

Preston.—Cement, bituminous coal, and crushed limestone were produced in the county in 1954. The Alpha Portland Cement Co., Manheim, produced cement, using limestone mined from its own quarry near Cheat River. Bituminous coal was produced from both underground and stripping operations. Most of the underground mines were small; none produced over 100,000 tons in 1954. Larger companies with underground mines were Kray Coal Co., Inc., Houck Reidler Bros. Coal Mining Co., Industrial Coal Co., Tri-State Mining Co., Tunnelton Cooperative Coal Co., and the Sandy Creek Fuel Corp. Of the strip mines, Kingwood Mining Co., was the largest producer; in fact, it was the largest coal producer in the county. Other large companies were Swaney Contracting Co., Inc., and Daugherty Coal Co.

Putnam.—A small quantity of bituminous coal constituted the entire mineral production of Putnam County in 1954. Three active pits were Hughes Coal Co., Zitzelbarger, and M. L. No. 2 mine and H. S. B. Thomas Coal Co. No. 1 mine.

Raleigh.—In addition to the mining of bituminous coal—the county's most important industry—crushed sandstone and a small quantity of sand and gravel were mined in 1954. Raleigh County ranked sixth in the State in bituminous-coal production. Major producers were the New River Co., with Stanaford Nos. 1 and 2 mines, Cranberry mine, Oswald and Sidney mines, and Skelton mine; Eastern Gas & Fuel Associates Stotesbury No. 8, and Stotesbury No. 11 mine, and Eccles No. 6; Armco Steel Corp. No. 1 mine; Slab Fork Coal Co. No. 1 mine; Winding Gulf Collieries No. 4 mine; Truax-Traer Coal Co., with underground and strip operations; Gulf Smokeless Coal Co. No. 2 mine; and C. H. Mead Coal Co., Division of North American Coal & Dock Co.

Crushed sandstone was produced by Lambert Bros., Inc., Mount Hope, on the Fayette County line for use in making concrete and as roadstone, and by Grandview Sand Co., Grandview, for making silica brick. Paving and structural sand was produced by the Table Rock Sand Co. from a pit near Beaver, where rock was quarried and sand manufactured.

Randolph.—Bituminous coal and crushed limestone were produced in Randolph County in 1954. Large mines included Bethlehem Mines Corp. Golden Ridge Nos. 92 and 6 mines, Three Fork Coal Co. Cassity Nos. 2 and 3 mines, Peerless Coals, Inc., strip mines, Norton Coal Co., Inc., Norton mines, Roaring Creek Coal Co., Inc., strip mines, and Ike Lewis Mining Co. strip mines.

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Crushed limestone was produced by Elkins Limestone Co., Elkins, from an underground operation for use in making concrete and as roadstone.

Summers.—Springdale Coal Co. Hump Mountain mine operated on a limited basis, producing bituminous coal in 1954.

Taylor.—Bituminous coal and clay were produced in Taylor County in 1954. Wendel Coal Co. No. 2 mine and Insel Coal Co. strip mines were major producers. Other underground producers were R & R Coal Co., Frances Coal Co., Mearns Mining Co., and I & M Coal Co.

Miscellaneous clay for brick manufacture was produced by Hammond Brick Co. from an open pit near Grafton.

Tucker.—Bituminous coal, produced primarily by Tucker County Coal Co., Inc., No. 43 mine and Thomas Engineering Co. strip mines at Elkins, was the only commodity produced in 1954. Other producers were Cumberland Coal Co. of Baltimore City and Compass Coal Co.

Tyler.—Sand and gravel was produced by Ohio River Sand & Gravel Corp. from a dredge on the Ohio River near New Martinsville for use as building and highway material.

Upshur.—Bituminous coal and clay were produced in 1954. The major coal producers were Reppert Fairmont Coal Co., Scott No. 4 mine; Pecks Run Coal Co., Kano mine; Badger Coal Co., Nos. 1 and 2 mines; Redstone Coal Mining Co., Mark Nos. 2 and 3 mines; and Hackers Creek Coal Co., No. 1 mine.

Fire clay, produced by Buckhannon Brick Co. from an open pit mine near Buckhannon, was used in manufacturing brick and tile.

Wayne.—Bituminous coal was produced in the vicinity of East Lynn by the following companies: Big Lynn Coal Co., Northland Coal Co., Trace Fork Coal Co., Fry Bros. Coal Co., Andrew J. Fry Coal Co., all underground operations; and Earl W. Swymn, strip mine.

The Laval Sand Co., Inc., produced engine sand from a dredge operated on Big Sandy River near Fort Gay.

Webster.—Pardee & Curtin Lumber Co. near Bergoo produced most of the county total of bituminous coal, operating underground, strip, and auger mines. Gauley Mountain Coal Co. was another large producer. Pike Coal Co. also reported coal production in 1954.

Wetzel.—Ohio Valley Sand Co., Inc., dredged sand and gravel from the Ohio River 2 miles north of New Martinsville for use in building and paving purposes and as railroad ballast.

Wood.—Ohio River Sand & Gravel Corp. produced sand and gravel, primarily for building and highway material, from the Parkersburg dredge on the Ohio River near Parkersburg.

Wyoming.—Bituminous coal and sand and gravel were produced in Wyoming County in 1954. By far the largest producing mine was Pocahontas Fuel Co. Itmann Colliery at Itmann. Other large producing companies included Eastern Gas & Fuel Associates, Semet-Solvay Division, Allied Chemical & Dye Corp., Red Jacket Coal Corp., Pond Creek Pocahontas Co., Jones & Laughlin Steel Corp., American Coal Co., Gulf Mining Co., and Crozer Coal & Land Co.

Sand and gravel was produced by Costo & Lackey Sand Co. from a river operation near Baileysville, for use as engine sand.

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The Mineral Industry of Wisconsin

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the Geological Survey of Wisconsin.

By Samuel A. Gustavson [1]

WISCONSIN mineral output in 1954 was nearly the same in value as in 1953. Increased production and value of cement, sand and gravel, and stone offset decreases in iron ore, lead, and zinc. Other commodities reported only minor changes, or changes were relatively unimportant to the total value of all minerals produced. The mineral of greatest value was sand and gravel, followed by stone, iron ore, cement, zinc, lime, and lead.

Table 1 lists the output and value of minerals produced in Wisconsin, 1953–54. Many ores contain valuable minor constituents recovered from plants that treat mixtures of materials from many sources. It is sometimes impossible in such instances to distribute these mineral products by place of origin. In Wisconsin minerals for which source data are not available may include byproduct sulfuric

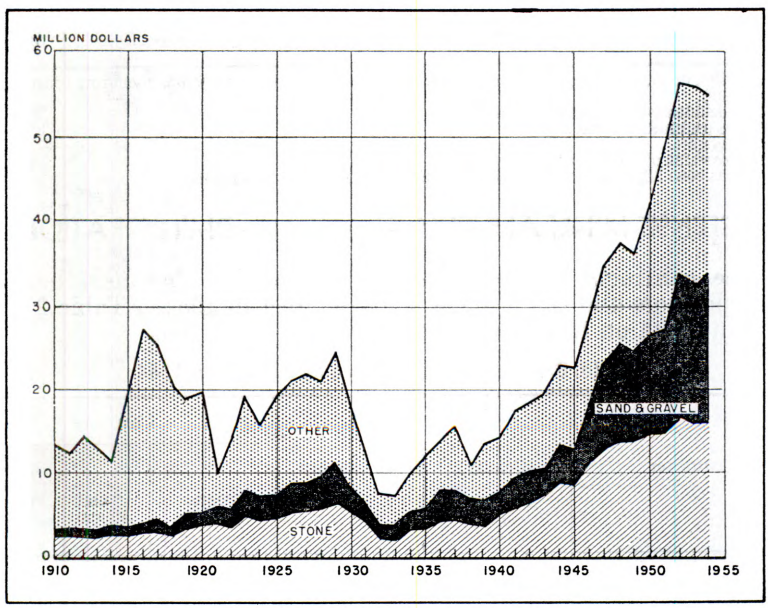

FIGURE 1.—Value of sand and gravel and stone and total value of minerals produced in Wisconsin, 1910–54.

[1] Chief, Field Office, Mineral Industry Division, Region V, Bureau of Mines, Minneapolis, Minn.

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acid and very small quantities of cadmium, all associated with zinc and lead ores.

Some of the production data for 1954 were collected jointly with the Bureau of Census (United States Department of Commerce). Production totals will be compared with the Census totals when they are available and differences adjusted or explained. Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences of coverage.

TABLE 1.—Mineral production in Wisconsin, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	175,311	$175,276	180,233	$174,488
Iron ore (usable)long tons, gross weight	1,655,331	(2)	1,428,910	(2)
Lead (recoverable content of ores, etc.)	2,094	548,628	1,261	345,514
Lime	123,997	1,566,085	115,397	1,557,579
Marl, calcareous	15,871	7,327	19,607	9,817
Peat	366	(2)	(2)	(2)
Sand and gravel [3]	[4] 23,664,086	[4] 16,253,302	23,978,722	17,396,438
Stone (except limestone for cement and lime; quartzite 1953)	7,450,396	[4] 15,979,756	8,289,373	16,187,738
Zinc (recoverable content of ores, etc.)	16,830	3,870,900	15,534	3,355,344
Undistributed: Abrasive stone (grinding pebbles and tube mill liners), cement, hydraulic lime cement (1953), quartzite (1953), and minerals whose value must be concealed for particular years, as shown by footnote 2		[5] 16,810,752		15,839,813
Total Wisconsin		[4] 55,212,000		[6] 54,286,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Value included with "Undistributed."
[3] Includes friable sandstone.
[4] Revised figure.
[5] Excludes value of clays used for cement.
[6] Total has been adjusted to eliminate duplication of value of clays and stone.

DEFENSE MINERALS EXPLORATION ADMINISTRATION

Three contracts for lead-zinc exploration in Wisconsin between mine operators and the DMEA were in effect in 1954. Table 2 gives pertinent data on these contracts.

TABLE 2.—DMEA contracts in effect during 1954

Contractor	County	Commodity	Contract		
			Date	Total amount	Government participation, percent
Eagle-Picher Co	Lafayette	Lead and zinc	June 11, 1952	$191,230.78	50
Piquette Mining & Milling Co.[1]	Grant	do	June 20, 1951	19,100.00	50
Vinegar Hill Zinc Co	Lafayette	do	Feb. 6, 1952	68,440.38	50

[1] E. P. Scallon, St. Paul, Minn., assigned property leases to Piquette Mining & Milling Co. on Oct. 19, 1953. Assignment of contract to new company approved by Government on Nov. 12, 1953.

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REVIEW BY MINERAL COMMODITIES

METALS

Iron Ore.—Shipments of iron ore from Wisconsin mines in 1954, following the decline in steel production, decreased 14 percent from 1953. Production decreased 15 percent. All production and shipments were from two underground mines, the Cary mine operated by Pickands, Mather & Co. and the Montreal mine operated by Oglebay, Norton & Co. Both mines are in Iron County on the Gogebic range. The shipping season at the Cary mine began in March, although a few tons was shipped all-rail from February to early December. Shipping from the Montreal mine began in April and ended in October.

In gross tons, stocks of ore at Wisconsin mines in January 1954 totaled 334,376 tons (revised figure). Production was 1.5 million tons. Shipments totaled 1.4 million tons, and year-end stocks were 396,936 tons. All ore produced was of direct shipping grade.

The value of the iron ore shipped, used to obtain the total mineral value for Wisconsin, was the mine value as reported by the companies before addition of transportation costs to consumers. Lake Erie base prices were: Mesabi non-Bessemer and High-Phosphorus $9.90 per ton, Mesabi Bessemer $10.05, Old Range non-Bessemer $10.15, Old Range Bessemer $10.30, and open-hearth lump ore $11.15. These prices were for ore delivered at lower Lake ports, carrying 51.5 percent natural iron content with 0.045 percent (max.) phosphorus (dry) for Bessemer grades; ores exceeding 0.18 percent phosphorus (dry) are classified as High-Phosphorus. Premiums and penalties were applied for variations in analyses and physical structure.

TABLE 3.—Iron-ore (hematite) production and shipments, 1950–54

Year	Number of mines	Production (gross tons)	Shipments (gross tons)	Iron content shipments, natural (percent)
1950	2	1,701,638	1,701,619	52.89
1951	2	1,757,234	1,745,120	52.41
1952	2	1,495,109	1,485,845	52.56
1953	3	1,756,150	1,655,331	52.48
1954	2	1,491,470	1,428,910	52.81

Lead and Zinc.—Many small operators that usually contribute to the production of lead and zinc from mines in Wisconsin were idle in 1954 due to the low price of zinc. Only mines of the Vinegar Hill Zinc Co. and Calumet & Hecla, Inc., were productive throughout the year. Production of lead, in terms of recoverable metal, in 1954 from Wisconsin mines totaled 1,261 tons, a 40-percent decrease from 1953. Zinc production in 1954 totaled 15,534 tons, an 8-percent decrease from 1953. All production was from mines in Grant, Iowa, and Lafayette Counties.

The principal producers of both lead and zinc were Calumet & Hecla, Inc., and Vinegar Hill Zinc Co., both with mines in Lafayette County. Other producers include H. Turner & Son, which purchased the Mifflin Mining Co. properties in April (this company operated from July 15 through November 15); Geo. M. Baker treated tailings

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TABLE 4.—Mine production of lead and zinc, 1945–49 (average) and 1950–54, in terms of recoverable metals

Year	Mines producing		Material treated		Lead		Zinc		Total value
	Lode	Tailings	Ore (short tons)	Tailings[1] (short tons)	Short tons	Value	Short tons	Value	
1945–49 (average)	45	3	247,749	288,983	1,250	$313,303	11,044	$2,685,113	$2,998,416
1950	11	1	186,083	19,600	532	143,640	5,722	1,625,048	1,768,688
1951	22	3	499,971	14,750	1,391	481,286	15,754	5,734,456	6,215,742
1952	24	10	670,332	82,146	2,000	644,000	20,588	6,835,216	7,479,216
1953	29	3	534,882	19,133	2,094	548,628	16,830	3,870,900	4,419,528
1954	7	11	523,755	39,799	1,261	345,514	15,534	3,355,344	3,700,858

[1] Partly estimated.

about the same period; and Eagle-Picher Co., Mining & Smelting Division, reopened its mines in northern Illinois and Wisconsin in June.

Eagle-Picher Co. purchased all Calumet & Hecla, Inc., zinc properties and mill in Wisconsin. They took over the operations August 15. Davis Mining Enterprises completed a new mill near Mifflin in Iowa County and began production in June.

The production of zinc in 1954 was valued at $3.4 million, compared with $3.9 million in 1953 and lead at $345,500 compared with $548,600. Average weighted prices (cents per pound) used for calculating these values were: Zinc 10.8 and lead 13.7 in 1954 and zinc 11.5 and lead 13.1 cents in 1953. These averages do not reflect the guaranteed price for zinc produced under contract with General Services Administration. Market prices for zinc (East St. Louis) opened 1954 at 10 cents per pound, reached a low of 9.25 cents February 15, and gradually rose to 11.5 cents September 7, remaining at that level through December 31. Lead prices (New York) opened 1954 at 13.5 cents per pound, decreased to 12.5 on February 18, then gradually increased to 15 cents on October 5, with no further change through December 31.

TABLE 5.—Mine production of lead and zinc in 1954, by months, in terms of recoverable metals, in short tons

Month	Lead	Zinc	Month	Lead	Zinc
January	134	1,071	August	105	1,548
February	104	1,073	September	98	1,529
March	127	1,295	October	87	1,399
April	96	973	November	90	1,393
May	112	1,064	December	84	1,150
June	135	1,559			
July	89	1,480	Total	1,261	15,534

NONMETALS

Cement.—The Manitowoc Portland Cement Co., a subsidiary of Medusa Portland Cement Co. of Cleveland, Ohio, produced portland cement at Manitowoc; output was slightly greater than in 1953. The average value in 1954 was $2.83 per barrel and $2.75 per barrel in

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1953. The Western Lime & Cement Co. produced hydraulic lime cement in 1953 but reported no production for 1954.

Clays.—Clays in Wisconsin are used for manufacturing cement, brick, and heavy clay products. Production was from pits in Brown, Dunn, Fond du Lac, Jackson, LaCrosse, Marathon, Racine, and Waupaca Counties. The output of clay for all uses in 1954 totaled 180,200 tons valued at $174,500, an increase of 3 percent in quantity; however, value decreased slightly.

Lime.—Both quicklime and hydrated lime were produced from high-calcium and high-magnesium limestones. Total production in 1954 was 115,397 tons valued at $1.6 million—a decrease of 7 percent in volume and less than 1 percent in value from 1953. The average price for all lime products was $13.50 per ton in 1954—an 87-cent increase over 1953.

There were plants in Brown, Calumet, Dodge, Douglas, Fond du Lac, and Manitowoc Counties. Western Lime & Cement Co. of Milwaukee was the principal producer.

Marl.—Production and sales of marl were reported by 8 operators in Wisconsin in both 1953 and 1954. Output increased 24 percent and value 34 percent over 1953. Counties with production in 1954 were Portage, Washburn, Waupaca, and Waushara. All output was for agricultural use.

Perlite.—Crude perlite from Western States was expanded at plants in Appleton and Milwaukee. The product was used principally as a lightweight aggregate in plaster and concrete.

Sand and Gravel.—Sand and gravel was produced in 1954 from 184 commercial operations. Also, 57 Government agencies (cities, counties, etc.) reported production or were contracting for production of sand and gravel.

Nearly 90 percent of the sand and gravel produced was utilized by the building- and road-construction industries. The balance of the output was used chiefly for glass manufacture as molding sand, filter sand, and railroad ballast.

The 10 leading commercial producers of sand and gravel in 1954 were: Chicago, Milwaukee, St. Paul & Pacific Railroad Co., Chicago, Ill.; Consumers Co., Chicago, Ill.; Courtney & Plummer, Inc., Neenah; Hartland Sand & Gravel Co., Hartland; Jaeger Sand & Gravel Co., Milwaukee; Janesville Sand & Gravel Co., Janesville; F. F. Mengel Co., Wisconsin Rapids; Portage-Manley Sand Co., Rockton, Ill.; A. J. Reiske Sons Co., Milwaukee; and Valley Sand & Gravel Co., Waukesha.

Stone.—Wisconsin produced granite, limestone, sandstone, and basalt in 1954. Dimension granite for architectural and monumental use was produced in Ashland, Marathon, Marquette, and Waushara Counties. Most of the stone was dressed at plants near the quarries, although some stone was marketed rough. Colors include black, gray, and red. Some granite was crushed for use as a concrete aggregate and roadstone. Production of limestone was widespread throughout the State. The major portion was crushed or ground for concrete aggregate, roadstone, agricultural lime, and industrial and chemical uses. Most of the dimension limestone was produced in Waukesha County. The principal product was cut stone and house veneer.

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TABLE 6.—Sand and gravel, sold or used by producers, 1953–54, by classes of operations and uses

Class of operation and use	1953 [1]			1954		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
COMMERCIAL OPERATIONS						
Sand: [2]						
Glass				110,844	$187,270	$1.69
Molding	(3)	(3)		566,659	820,160	1.45
Building	1,984,787	$1,496,557	$0.75	2,698,027	2,184,277	.81
Paving	1,164,428	948,319	.81	649,063	570,270	.88
Filter				7,415	3,402	.46
Railroad ballast	56,873	32,282	.57	(3)	(3)	
Other	262,459	109,405	.42	366,447	174,868	.46
Undistributed [4]	629,958	1,231,624	1.96	75,841	140,109	1.93
Total commercial sand	4,098,505	3,808,187	.93	4,474,296	4,080,356	.91
Gravel:						
Building	1,995,251	1,588,501	.80	2,786,990	2,376,825	.85
Paving	4,661,254	3,359,064	.72	4,270,359	3,396,608	.80
Railroad ballast	1,249,717	531,152	.43	855,996	418,223	.49
Other	142,697	65,929	.46	483,243	302,719	.63
Total commercial gravel	8,048,919	5,544,646	.69	8,396,588	6,494,375	.77
Total commercial sand and gravel	12,147,424	9,352,833	.77	12,870,884	10,574,731	.82
GOVERNMENT-AND-CONTRACTOR OPERATIONS						
Sand:						
Building				20,882	7,472	.36
Paving	2,504,979	1,405,743	.56	1,110,219	444,095	.40
Total Government-and-contractor sand	2,504,979	1,405,743	.56	1,131,101	451,567	.40
Gravel:						
Building				59,774	17,932	.30
Paving	9,011,683	5,494,726	.61	9,916,963	6,352,208	.64
Total Government-and-contractor gravel	9,011,683	5,494,726	.61	9,976,737	6,370,140	.64
Total Government-and-contractor sand and gravel	11,516,662	6,900,469	.60	11,107,838	6,821,707	.61
ALL OPERATIONS						
Sand	6,603,484	5,213,930	.79	5,605,297	4,531,923	.81
Gravel	17,060,602	11,039,372	.65	18,373,325	12,864,515	.70
Grand total	23,664,086	16,253,302	.69	23,978,722	17,396,438	.73

[1] Revised figures.
[2] Includes friable sandstone.
[3] Included with "Undistributed" to avoid disclosure of individual company operations.
[4] Includes molding and blast sand (1953); blast, engine, ground, and railroad ballast sand (1954).

Sandstone and quartzite were produced in Marathon, Rock, Sauk, and Wood Counties. Dimension sandstone, produced primarily in Wood County, was marketed as rough and dressed architectural stone and flagging. Quartzite produced in Sauk County was used for grinding pebbles and tube-mill liners. Crushed quartzite was used for refractories. In Marathon County quartzite was produced and ground for use as an abrasive. A hard, argillaceous sandstone was crushed, sized, and used for roofing granules. A portion of these granules is artificially colored. Basalt in Marinette County was produced for use as roofing granules. Some miscellaneous stone also was produced.

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TABLE 7.—Dimension stone sold or used by producers, 1953–54, by kinds and uses

Kind and use	1953			1954		
	Quantity	Value	Average value	Quantity	Value	Average value
Granite: Architectural and monumental:						
Rough cubic feet	54,208	[1] $274,466	[1] $5.06	48,985	$233,858	$4.77
Dressed do	78,181	1,151,845	14.73	72,802	1,182,268	16.24
Total granite equivalent short tons [2]	10,922	[1] 1,426,311	[1] 130.59	10,048	1,416,126	140.94
Limestone:						
Rough construction:						
Commercial short tons	18,081	48,969	2.71	11,209	53,069	4.73
Noncommercial do	480	72	.15	620	682	1.10
Rubble:						
Commercial do	10,084	29,244	2.90	5,588	12,150	2.17
Noncommercial do	715	107	.15	1,950	2,025	1.04
Rough architectural cubic feet	96,504	183,736	1.90	24,001	26,107	1.09
Dressed (cut and sawed) do	262,468	686,507	2.62	364,812	807,007	2.21
Flagging do	73,932	67,743	.92	65,157	81,313	1.25
Total commercial equivalent short tons [2]	62,797	1,016,199	16.18	53,115	979,646	18.44
Total noncommercial short tons	1,195	179	.15	2,570	2,707	1.05
Total limestone equivalent short tons [2]	63,992	1,016,378	15.88	55,685	982,353	17.64
Sandstone, all uses short tons	3,118	71,814	23.03	4,185	29,942	7.15
Total dimension stone equivalent short tons [2]	78,032	[1] 2,514,503	[1] 32.22	69,918	2,428,421	34.73

[1] Revised figure.
[2] Following average weights per cubic foot used in converting to short tons: Granite, 165 pounds; limestone, 160 pounds; sandstone, 160 pounds.

TABLE 8.—Crushed and broken stone sold or used by producers, 1953–54, by kinds and uses

Kind and use	1953			1954		
	Short tons	Value	Average per ton	Short tons	Value	Average per ton
Basalt, granite, sandstone, and miscellaneous stone: All uses, commercial and noncommercial	1,113,101	$6,362,188	$5.72	917,600	$5,913,421	$6.44
Limestone:						
Riprap:						
Commercial	34,255	39,674	1.16	105,482	72,527	.69
Noncommercial	700	980	1.40	2,250	2,250	1.00
Flux	18,674	21,469	1.15	26,538	32,169	1.21
Refractory (dolomite)	[1]	[1]		24,638	26,609	1.08
Concrete aggregate, roadstone, etc:						
Commercial	4,520,707	4,837,537	1.07	5,536,843	5,786,292	1.05
Noncommercial	428,925	396,650	.92	494,099	415,358	.84
Railroad ballast	157,639	198,075	1.26	105,419	126,989	1.20
Agriculture:						
Commercial	786,276	1,166,685	1.48	627,335	883,826	1.41
Noncommercial	167,835	234,737	1.40	132,986	211,363	1.59
Other:						
Commercial	144,252	207,258	1.44	239,898	287,240	1.20
Noncommercial				6,367	1,273	.20
Total commercial	5,661,803	6,470,698	1.14	6,666,153	7,215,652	1.08
Total noncommercial	597,460	632,367	1.06	635,702	630,244	.99
Total limestone	6,259,263	7,103,065	1.13	7,301,855	7,845,896	1.07
Grand total	7,372,364	13,465,253	1.83	8,219,455	13,759,317	1.67

[1] Included with "other."

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MINERAL FUELS

Fuel Briquets and Packaged Fuel.—Several companies produced coal or coke briquets and packaged fuel. In 1954, 12,767 tons of packaged fuel valued at $236,546 was produced in the State. The Milwaukee Solvay Coke Co. produced coke.

Peat.—Blondey & Blondey of New London was the only company reporting output of peat in 1954. Production was moss peat from a bog near New London, Outagamie County.

REVIEW BY COUNTIES

Adams.—Sand and gravel for building use was produced by Arthur Overgaard Co., Elroy, from a pit near Oxford. The State highway commission and Juneau County Highway Department contracted for production of sand and gravel for highway use.

Ashland.—Granite, described as "veined ebony black," was produced by the Cold Spring Granite Co. from the Mellen quarry. Finishing was done at the company plant, Cold Spring, Minn. Otto Wiesner, Inc., of Superior produced gravel for road use from a pit in Gurney Township, Ashland County.

Barron.—Barron County Agricultural Department produced slightly over 100,000 tons of limestone for agricultural use. Sand and gravel for building and road construction was produced by Clyde Lilly, Poskin. H. T. Smith, Hixton, produced road gravel and Barron County Highway Department produced sand and gravel for highway use.

Brown.—Clays were produced by Duck Creek Brick Co. and Hockers Bros. Brick & Tile Co., chiefly for brick and tile manufacture. Western Lime & Cement Co. of Milwaukee produced quick and hydrated lime from limestone from local quarries at its Green Bay plant. The products were sold for chemical and industrial use. Dimension limestone used chiefly as rough building stone, house veneer, and flagging was produced by Nels Scray and Victor De Cleene, both of De Pere. Limestone for road and/or agricultural use was produced by Daanen & Janssen and by contractors for the town of Howard. Sand and gravel, employed chiefly for building construction and road use, was produced in Brown County. Producers include: Kenneth J. Careful and Daanen & Janssen, De Pere; Flor Evraets, O. K. Sand & Gravel Co., and Frank Van Nelson Excavating, Green Bay; Ed Kocken, West De Pere; Francis Peters, Suamico; Schuster Construction Co., Denmark; W. B. Sheedy Construction Co., Pulaski; and William Winkler & Sons Construction Co., Greenleaf. Sand and gravel for road use was purchased by Green Bay Street Department and the State highway commission.

Buffalo.—H. O. Tiffany, Jr., produced limestone near Nelson for rough construction and road and agricultural use. Limestone for agricultural purposes and/or road construction was produced by Neuheisel Lime Works, Mondovi, and H. E. Kochenderfer, Cochrane.

Calumet.—Quick and hydrated lime was produced by the Western Lime & Cement Co. at its High Cliff plant. The company also produced crushed limestone. Sand and gravel, nearly all of which was used either in building construction or on roadwork, was produced

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TABLE 9.—Value of mineral production in Wisconsin, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value
Adams	----------	(2)	Sand and gravel.
Ashland	(2)	(2)	Sand and gravel, stone.
Barron	$212,960	$218,506	Do.
Brown	907,440	1,011,410	Sand and gravel, lime, stone, clays.
Buffalo	187,834	(2)	Stone.
Burnett	28,388	105,767	Sand and gravel, stone.
Calumet	156,810	178,111	Sand and gravel, stone, lime.
Chippewa	(2)	(2)	Sand and gravel.
Clark	133,550	133,921	Do.
Columbia	1,216,552	1,045,222	Sand and gravel, stone.
Crawford	34,024	194,495	Stone, sand and gravel.
Dane	1,296,381	903,658	Sand and gravel, stone.
Dodge	600,768	741,357	Lime, sand and gravel, stone.
Door	178,571	248,304	Sand and gravel, stone.
Douglas	764,273	638,879	Lime, sand and gravel.
Dunn	30,142	65,203	Sand and gravel, stone, clays.
Eau Claire	14,139	12,668	Sand and gravel.
Florence	(2)	----------	
Fond du Lac	750,212	842,852	Stone, sand and gravel, lime, clays.
Forest	80,902	89,338	Sand and gravel.
Grant	456,889	492,496	Stone, sand and gravel, zinc.
Green	366,411	354,441	Stone, sand and gravel.
Green Lake	(2)	366,403	Sand and gravel.
Iowa	237,802	514,910	Stone, zinc, lead.
Iron	(2)	(2)	Iron ore, sand and gravel.
Jackson	----------	(2)	Sand and gravel, clays.
Jefferson	140,583	92,975	Sand and gravel, stone.
Juneau	223,497	64,745	Do.
Kenosha	190,954	242,212	Sand and gravel.
Kewaunee	(2)	(2)	Do.
La Crosse	69,673	128,713	Sand and gravel, clays, stone.
Lafayette	4,188,486	3,456,340	Zinc, lead.
Langlade	(2)	(2)	Sand and gravel.
Lincoln	101,114	(2)	Do.
Manitowoc	5,650,331	5,506,470	Cement, sand and gravel, lime, stone.
Marathon	5,213,270	5,186,496	Stone, sand and gravel, clays.
Marinette	812,183	871,757	Stone, sand and gravel.
Marquette	289,012	224,311	Do.
Milwaukee	832,676	1,509,159	Sand and gravel, stone.
Monroe	136,856	242,617	Stone, sand and gravel.
Oconto	245,252	(2)	Sand and gravel.
Oneida	176,504	176,731	Sand and gravel, stone.
Outagamie	194,500	386,877	Stone, sand and gravel, peat.
Ozaukee	(2)	258,256	Sand and gravel.
Pepin	----------	11,620	Stone.
Pierce	118,472	510,376	Sand and gravel, stone.
Polk	347,987	389,508	Stone, sand and gravel.
Portage	267,669	291,883	Sand and gravel, stone, marl.
Price	10,282	420	Sand and gravel.
Racine	824,788	694,841	Stone, sand and gravel, clays.
Richland	254,477	(2)	Stone, sand and gravel.
Rock	1,372,226	1,362,772	Sand and gravel, stone, ground sand.
Rusk	(2)	69,780	Sand and gravel.
St. Croix	537,258	365,250	Sand and gravel, stone.
Sauk	1,746,209	1,424,035	Stone, sand and gravel, abrasives.
Sawyer	55,281	83,234	Sand and gravel.
Shawano	181,455	160,557	Sand and gravel, stone.
Sheboygan	341,620	405,463	Do.
Taylor	65,000	(2)	Sand and gravel.
Trempealeau	(2)	31,000	Stone.
Vernon	461,134	569,547	Stone, sand and gravel.
Vilas	132,259	(2)	Sand and gravel.
Walworth	195,656	349,316	Do.
Washburn	1,090	1,500	Marl.
Washington	397,708	573,432	Sand and gravel, stone.
Waukesha	2,956,864	3,780,998	Do.
Waupaca	8,539	113,472	Sand and gravel, clays, marl.
Waushara	7,223	54,902	Sand and gravel, stone, marl.
Winnebago	1,187,595	1,188,337	Stone, sand and gravel.
Wood	226,527	(2)	Do.
Undistributed	17,395,768	15,347,894	
Total	55,212,000	54,286,000	

[1] Bayfield County is not listed because no production was reported.
[2] Included with "Undistributed."

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by Arnold M. Ortlepp, Chilton; Quality Sand & Gravel Co., Wrightstown, at its pit near Brillion; and Sell Bros., Appleton. The Calumet County Highway Department produced gravel and crushed limestone for road use.

Chippewa.—Chippewa Sand & Gravel Co. produced sand and gravel from a pit near Chippewa Falls. Its output was used by the building trade. H. T. Smith, Hixton, produced road gravel from a pit in Chippewa County.

Clark.—Sand and gravel producers in Clark County were Charles Marek & Son, Merillan; Paul Brothers, Owen; Plautz Bros., Willard, who operated pits in Eaton and Hixon Townships; and Clark County Highway Department. Most of the material produced was used in building or highway construction.

Columbia.—Limestone was produced by Dann & Wendt, Rio, for agricultural use and by Edward Kraemer & Sons for road use. Glass, molding, and filter sands were produced by Ladwig Sand & Gravel, Columbus, and Portage Manley Sand Co., Portage.

Crawford.—Edward Kraemer & Sons, Loren J. Slaght, and H. Turner & Sons produced crushed limestone for road construction in the county. Velda Ward and Velmer Monroe produced ground limestone for agricultural use. Frank Mezera (Eastman), Prairie Sand & Gravel Co. (Prairie du Chien), and Stenner & Schneider (Fennimore) operated sand and gravel pits in Crawford County. Production was used for building and road purposes.

Dane.—Companies producing sand and gravel included: Boehnen, Inc., Cross Plains; Capital Sand & Gravel Co., Madison Sand & Gravel Co., Rein & Schultz, Inc., Speedway Sand & Gravel Co., and Stewart Watson Construction Co., all of Madison; Einar Evenson & Sons, Cambridge; Hartland Verona Gravel Co., Verona; Charles Langer & Son, Waterloo; Maier & Ketelbodter and F. H. Raemisch Sons, Inc., Waunakee; Henry A. Raemisch Co., Middleton; August Shemanek, Black Earth; and Sundby Sand & Gravel Co., Stoughton. Uses were as molding sand and for building and road construction. Producers of limestone, chiefly for road or agricultural use, in 1954 were: Boehnen, Inc., Alva Brumm, Norman Carpenter, Rein & Dahl, Einar Evenson, Kuhnau & Hosig Bros., Elden Quam, Carl F. Raemisch, Stewart Watson, and Wingra Stone Co.

Dodge.—Quicklime and hydrated lime were produced by Western Lime & Cement Co. and quicklime only by Mayville White Lime Works. These two companies also produced limestone for use as rubble and road construction. Gravel for building and road construction was mined by Edward Brunt & Eugene Frings near Watertown and Melvin Voigt, Ashippun. Dodge County Highway Department produced sand and gravel for road use, and both the county and the State highway commission purchased road gravel.

Door.—Dimension limestone was produced by Adamski & Emil Fisher, Sturgeon Bay. Limestone for industrial use was produced by Clare R. Schuur. Crushed limestone for road construction was produced by Door County Highway Department. Hubert Charles, Luxemburg, operated a sand pit in Union Township for production of paving sand. Howard Serrahn produced gravel for building use at Sturgeon Bay. Door County Highway Department produced road

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gravel, and the State highway commission contracted for paving sand and gravel.

Douglas.—Lime was produced by the Cutler-LaLiberte-McDougall Corp., Superior, for building, chemical, and industrial uses. The city of Superior produced sand for building use, and Douglas County Highway Department produced and purchased sand and gravel for roadwork.

Dunn.—Menomonie Brick Co., Menomonie, produced clays for manufacturing building brick and heavy clay products. The Downsville Cut Stone Co., Downsville, produced rough and dressed sandstone for building purposes. The Dunn County Highway Commission produced crushed limestone for road construction. Red Cedar Sand & Gravel Co. produced sand and gravel for building purposes at Menomonie. The Minneapolis, St. Paul & Saulte Ste. Marie Railroad Co. mined gravel for its own use.

Eau Claire.—The city of Eau Claire produced road gravel and purchased sand for paving.

Fond du Lac.—Oakfield Shale Brick & Tile Co., Oakfield, produced clays for manufacturing building brick and heavy clay products. Western Lime & Cement Co., Milwaukee, produced lime at its Eden Plant for building, agricultural, chemical, and industrial uses. Rough and finished limestone for architectural use and crushed limestone for road construction and agricultural use were produced by the Fond du Lac Stone Co. and Hamilton Stone Co., both of Fond du Lac. Crushed limestone for road construction was produced by Edward Kraemer & Sons. Sand and gravel for building and road use was produced in Fond du Lac County. Braun Construction Co. and Lake View Sand & Gravel Co. operated pits near Fond du Lac. Schroeder Bros. Sand & Gravel Co., Elkhart Lake, produced sand and gravel from a pit in Forest Township. Sell Bros., Appleton, and the Fond du Lac County Highway Department produced gravel for highway use.

Forest.—Gravel for railroad ballast was mined by the Minneapolis, St. Paul & Sault Ste. Marie Railroad Co. Forest County Highway Department produced road gravel.

Grant.—Crushed limestone for use as riprap, railroad ballast, road construction, and agricultural lime was produced by Becker & Tuckwood, Lancaster; Joe C. Hartnett, Platteville; Dell Needham, Fennimore; E. C. Schroeder Co., Inc., McGregor, Iowa; and Zenz & Sturmer, Bloomington. Stenner & Schneider, Fennimore, produced sand and gravel for building and road use. Grant County Highway Department mined building sand. Several individuals produced and shipped small quantities of lead or zinc ore. All were operating on a part-time basis. The Piquette Mining & Milling Co. as a result of prospecting and developing its properties near Tennyson produced and shipped a small tonnage of lead-zinc ore for test purposes. Cuba Mining Co. conducted only prospecting and made no shipments during the year.

Green.—Crushed limestone for road construction and agricultural use was produced by William Rees, Monroe; P. W. Ryan & Sons, Janesville; and Waelti Lime & Gravel Co., Juda. Sand and gravel was produced in Green County by Henry Altmann and the Green County Sand & Gravel Co., Inc., both at Monroe. Green County

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Highway Department produced sand and purchased gravel for road use.

Green Lake.—Molding sand and sand and gravel for construction use was produced in Green Lake County. Producing from pits located in or near Berlin were C. A. Chier Sand Co., Edward Chier, Leonard & Theodore Chier Sand Co., F. B. Dubberstein & Sons, Inc., and A. F. Gelhar Co., Inc. Other operators include Fox Valley Sand & Gravel, Ripon; Kopplin & Kinas Co., Inc., Green Lake; Clifford J. Maginnis, Dalton; and Paul Polenska & Son, Manchester.

Iowa.—Crushed limestone for road construction was produced by Stewart Watson, Madison, and Iowa County Highway Commission. Wonn & Bailey, Cobb, produced crushed limestone for road construction and agricultural use. Davis Mining Enterprises operated an underground mine and a combination gravity-flotation mill near Linden. The company reported milling 40,040 tons of crude material, from which 16 tons of lead concentrate and 1,162 tons of zinc concentrate were made. Most of the ore was from the company property; however, a few tons of ore from nearby dumps and inactive mines was treated, and some ore from the Coker No. 1 mine was milled for the Mifflin Mining Co. The Davis Mining Enterprises started developments in its mine in 1951. In 1953 construction of a mill was begun, and first production was in June 1954.

Iron.—Iron County Highway Department produced road gravel. Iron ore was produced from the Cary mine operated by Pickands, Mather & Co. and the Montreal mine operated by Oglebay, Norton & Co. Both mines are on the Gogebic range. These were the only iron-ore producers in the State in 1954.

Jackson.—Birdine F. Bright, Black River Falls, produced miscellaneous clay for use in manufacturing heavy clay products. H. T. Smith, Hixton, produced road gravel for local use.

Jefferson.—Donald Diekow, Jefferson, produced crushed limestone for agricultural use. Sand and gravel was produced in the county by Joe Claute and Hausz Bros., Fort Atkinson, and Jefferson County Highway Department.

Juneau.—Crushed limestone for road construction was produced by Edward Kraemer & Sons, Plain. Juneau County Highway Department produced sand and purchased gravel for road use.

Kenosha.—Sand and gravel was produced by Bloss Sand & Gravel, Salem; Sam S. Sorenson, Woodworth; and Ray Wertz Excavating Co. and William Wertz, Wilmot. The city of Kenosha and Kenosha County Highway Department produced sand and gravel for road use.

Kewaunee.—Casco Sand & Gravel Corp., Casco, mined paving sand and gravel for building use and railroad ballast.

La Crosse.—Meir Brick Co., La Crosse, produced clays for manufacturing building brick and heavy clay products. Herbert Hass produced rough construction limestone. Sand and gravel was mined in La Crosse County by Kammel-Smith Sand & Gravel Co., Inc., and LaCrosse Sand & Gravel Co., Inc., both at La Crosse; and Medary Sand & Gravel Co., Onalaska. La Crosse County Highway Department produced paving sand.

Lafayette.—Calumet & Hecla, Inc., operated its lead-zinc mine and combination gravity and flotation mill until August 15, when Eagle-Picher Mining Co. took physical control and continued the

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operation. Eagle-Picher Mining Co. purchased all properties of Calumet & Hecla, Inc., in Wisconsin. Vinegar Hill Zinc Co. operated the Blackstone, Hancock, and Mulcahy mines and its custom concentration mill. These operations were continuous throughout the year. Other operators produced either part time or summer months only. The more important of these in production were: George M. Baker, who operated a flotation mill near Shullsburg from May to December, treating old "boulder piles" or tailing, the Big Dick Mining Co., and the Fowler Mining Co.

Langlade.—Duffek Sand & Gravel, Inc., produced sand and gravel for construction use at Antigo. Langlade County Highway Department produced road gravel.

Lincoln.—In Lincoln County sand and gravel was produced by the Merrill Gravel & Construction Co., Merrill, and Thayer Sand & Gravel Co., Tomahawk. Output was used for building and road construction. Lincoln County Highway Department produced road gravel.

Manitowoc.—The Manitowoc Portland Cement Co., Manitowoc, operated the entire year. The Rockwell Lime Co., Chicago, Ill., produced lime for building, chemical, and industrial use at its Francis Creek plant. Valders Lime & Stone Co., Inc., Valders, produced lime for building. It also produced dimension limestone for building and architectural use. Crushed limestone for agriculture and road construction was produced by the Rockwell Lime Co. of Chicago, Ill. The city of Manitowoc produced crushed limestone. Sand and gravel was produced by Muth Knechtel Construction Co., Manitowoc; Walter L. Zander, Two Rivers; Schroeder Bros. Sand & Gravel Co., Elkhart Lake, at a pit in Schleswig Township; city of Manitowoc; and Manitowoc County Highway Department. Most of the material was used in construction or road building.

Marathon.—Marshfield Brick & Tile Co., Marshfield, produced clays for the manufacture of building brick and other clay products. Rough and dressed granite for building and monuments was produced by Anderson Bros. & Johnson Co., Lake Wausau Granite Co., DeVoe Granite Co., and Rib Mountain Granite Co., all of Wausau; and Cold Spring Granite Co., Cold Spring, Minn. Minnesota Mining & Manufacturing Co. produced quartzite for manufacturing abrasives and produced an argillaceous sandstone for manufacturing roofing granules. Production of sand and gravel was reported by Frances Gesicki, Edgar; Carl Lemke, Marathon; and Lotz Sand & Gravel Co. and Riverside Sand & Gravel Co., both in Wausau. Some filter sand was produced in addition to building and paving sand and gravel.

Marinette.—Crushed basalt was produced by the Central Commercial Co. of Chicago, Ill., for manufacturing roofing granules. Walsh Sand & Gravel Co., Menominee, Mich., operated a sand and gravel pit near Porterfield. The Minneapolis, St. Paul & Sault Ste. Marie Railroad Co. produced railroad ballast.

Marquette.—Montello Granite Co., Montello, produced polished monumental granite. Edward Kraemer & Sons produced crushed limestone for road construction. Marquette Highway Department produced gravel for road use.

Milwaukee.—Crushed limestone for road construction was produced by Franklin Stone Products, Inc.; and Manegold Stone Co., Milwaukee Limestone Products Co., and A. J. Reiske Sons Co., all of

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Milwaukee. Molding sand and building and paving sand and gravel were produced in Milwaukee County. Operators included Ray Anderson Sand & Gravel Co., Moritz Sand & Gravel, and Sweeney Sand & Gravel Corp., Hales Corners; Frank Clark & Sons, West Allis; Fink Sand & Gravel, South Milwaukee; General Silica Co., Inc., Merget Sand & Gravel, A. J. Reiske Sons Co., and Walter H. Rowe, Milwaukee.

Monroe.—Crushed limestone for road construction and agricultural use was produced by Ray Frings, Tomah; Otto Meyer, Sparta; and Schendel Bros., Norwalk. Otto Meyer & Son, Sparta, produced road gravel.

Oconto.—Gravel producers were Belongia Construction Co., Oconto; John Jaworski, Sobieski; and Henry F. Thompson, Oconto Falls. Output was chiefly for concrete aggregate and road construction.

Oneida.—Musson Bros., Rhinelander, produced crushed stone for refractory use and road construction. Webber Coffen (Lake Tomahawk), Dean B. Ekstrom and Musson Bros. (Rhinelander), Kotarski Sand & Gravel Co. (Three Lakes), and Oneida County Highway Department mined sand and gravel in Oneida County. Most of the material was used in construction work and paving.

Outagamie.—Blondey & Blondey, New London, produced peat moss for agricultural purposes. Crushed limestone for road construction was produced by Landwehr & Hackle, Seymour. Sand and gravel was produced by Landwehr & Hackle, Seymour; M. R. K. Construction Co., Inc., Kaukauna; and Frank Murphy, Appleton. The material was used in building and road construction.

Ozaukee.—Sand and gravel producers include Kleist Sand & Gravel Co. and Otto Ladwig & Sons, Inc., both of Milwaukee, who operated pits at Thiensville; and H. O. Muehlberg Gravel Co., Port Washington. Ozaukee County Highway Department also produced sand and gravel for road use.

Pepin.—Neuheisel Lime Works operated a limestone quarry at Durand, producing crushed limestone for road construction and agricultural use. The home office is in Eau Claire. The company also operates in Trempealeau and Buffalo Counties.

Pierce.—Edward Kraemer & Sons, Plain, and H. Turner & Sons, River Falls, produced crushed limestone for road construction. Crushed limestone for road construction and agricultural use was produced by Ed. J. Leary Estate, River Falls, and Otto Sanders, Inc., Elmwood. Molding, blast, engine, and filter sands, as well as sand and gravel for use in construction work, were mined in Pierce County. Production was reported by Bay City Sand Co. and Funk Bros., Bay City; Maiden Rock Silica Sand Co., Maiden Rock; River Falls Sand & Gravel Co., River Falls; Rush River Sand & Gravel Co., Ellsworth; and Pierce County Highway Department.

Polk.—Dresser Trap Rock Co., Dresser, produced crushed basalt for use as riprap, concrete aggregate, and railroad ballast. The Polk County agricultural agent produced crushed limestone for agricultural use. Polk County Highway Department produced crushed limestone and sand and gravel for road construction. Jorgenson Construction Co., Luck, produced sand and gravel.

Portage.—Ellis Stone Construction Co., Stevens Point, produced dressed sandstone. Bert Somers produced calcareous marl for agri-

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cultural use. F. F. Mengel Co., Wisconsin Rapids, produced sand and gravel in Stockton Township near Custer. Gilford Wimme, Stevens Point, also reported production. Portage County Highway Department produced road sand, and the State highway commission contracted for sand and gravel.

Racine.—Union Grove Drain Tile Co., Union Grove, produced clays for manufacturing heavy clay products. Consumers Co. of Illinois, Chicago, Ill., produced crushed limestone for riprap, blast-furnace, flux, refractories, road-construction, railroad-ballast, and agricultural and industrial use at its Racine quarry. Hillside Sand & Gravel Co., Racine, and the Racine County Highway Department produced sand and gravel.

Richland.—Edward Kraemer & Sons, Plain, and Richland County Highway Department produced crushed limestone for road use. Bock Bros. produced paving and building sand and gravel at a pit in Eagle Township near Muscoda.

Rock.—Crushed limestone for road construction and agricultural use was produced by Clinton Limestone Co., Clinton; Peter J. Roth, and P. W. Ryan & Sons, Janesville; H. E. Wheeler, Elkhorn; and Rock County Highway Department. Frank Bros., Milton Junction, produced crushed limestone for riprap, road construction, and agstone. The Lyle T. Manley Co., Rockton, Ill., produced ground sandstone for abrasive use. Sand and gravel for building and road construction, and railroad ballast was produced in the county. Producers include Atlas Sand & Gravel Co. and Janesville Sand & Gravel Co., Janesville; Consumers Co. of Chicago, Ill., at Afton; Edgerton Sand & Gravel Co., Edgerton; William J. Kennedy & Son, Footville; Luety Bros., Beloit; F. H. Raemisch of Waunakee; Chicago, Milwaukee, St. Paul & Pacific Railway Co., and Rock County Highway Department.

St. Croix.—St. Croix County Highway Department produced miscellaneous stone and sand and gravel for road construction. Casey Gravel Works, New Richmond, and Ed. J. Leary Estate, River Falls, produced sand and gravel.

Sauk.—Baraboo Quartzite Co., Baraboo, produced grinding pebbles and tube-mill liners, as well as crushed quartzite for refractory uses. Other producers of refractory material were John D. Geoghegan, Baraboo; General Refractories Co., Philadelphia, Pa.; and Harbison-Walker Refractories Co., Pittsburgh, Pa. Edward Kraemer & Sons, Plain, and Matashek Bros., Prairie du Sac, produced crushed limestone for road construction and agricultural use. Deppe Lumber Co. and W. R. Dubois & Son, Inc., Baraboo, reported production of sand and gravel. Sauk County Highway Department produced and purchased sand and gravel for road use.

Shawano.—Shawano County Agricultural Committee and Shawano County Highway Department produced crushed limestone for road construction and agricultural use. Sand and gravel was produced by Herman Dey, Tigerton; Riemer Sand & Gravel, Oconto; Edward Weichoff, Seymour; M. J. Zimmerman Construction Co., Shawano; and Shawano County Highway Department. Output was employed in building and road construction.

Sheboygan.—The Sheboygan County agricultural agent and Sheboygan County Highway Commission produced crushed limestone for road construction and agricultural use. Molding sand, railroad ballast,

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and sand and gravel for use in constructing buildings and roads were produced in the county. Producers include Cascade Sand & Gravel Co., Cascade; Crystal Lake Crushed Stone Co., Sheboygan; and Elkhart Moraine Sand & Gravel Co., Elkhart Lake. Sand and gravel for road use was produced by the Sheboygan County commissioners. The State highway commission placed contracts for sand and gravel.

Trempealeau.—Neuheisel Lime Works produced crushed rock for road construction and agricultural use at Arcadia. This company also operated limestone quarries in Buffalo and Pepin Counties.

Vernon.—Ellefson Bros., Viroqua, and Edward Kraemer & Sons, Plain, produced crushed limestone for road construction and agricultural use. Ed Muller & Sons, La Farge, produced crushed limestone for riprap and also mined road gravel. Vernon County Highway Commission produced rough dimension limestone for building purposes and road sand.

Vilas.—Gravel was produced by Otto Wiesner, Inc., Superior, and Vilas County Highway Department. Uses were chiefly as concrete aggregate and road surfacing.

Walworth.—Sand and gravel was produced principally for railroad ballast and building and road construction. Producers include Bernard R. Amon & Sons, Mann Bros. Sand & Gravel, Inc., and L. F. Stoflet & Sons, Inc., all of Elkhorn; Community Sand & Gravel, Delavan Sand & Gravel Co., Inc., and J. F. Thorpe, Delavan; Lake Geneva Sand & Gravel Co., Fontana; and R. W. Miller, Lake Geneva. Walworth County Highway Department and the State highway commission contracted for sand and gravel.

Washington.—Washington County Highway Commission produced crushed limestone for road construction. Sand and gravel producers include John B. Jacklin, Richfield; Northern Sand & Gravel Co., Fred C. Schultz & Son, and West Bend Sand & Gravel Co., West Bend; O. & W. Gravel Co., Port Washington; Ozaukee Sand & Gravel Co., Milwaukee; Palmer Crushing Co., Slinger; Minneapolis, St. Paul & Sault Ste. Marie Railroad Co.; and Washington County Highway Commission. The State highway commission placed contracts for sand and gravel. Most of the output was employed in building and highway construction.

Waukesha.—Dimension limestone for construction and architectural use was produced by the Cawley quarry, Fonda Lannon Stone Co., and White Rock Lannon Stone Co., all of Lannon; Halquist Lannon Stone Co. and Quality Limestone Products, Inc., Sussex; and W. G. Perren and Wisconsin Lannon Stone Corp., Waukesha. Crushed limestone for riprap, railroad ballast, road construction, and agricultural and industrial use was produced by Halquist Lannon Stone Co. and Quality Limestone Products, Inc., Sussex, and the Waukesha Lime & Stone Co., Inc., Waukesha. Sand and gravel, chiefly for construction use and railroad ballast, was produced in Waukesha County. Milwaukee firms operating in the county include Wm. Buege, Jaeger Sand & Gravel Co., Inc., Edward Lutz Sand & Gravel Co., Inc., Merget Sand & Gravel, and State Washed Sand & Gravel Co. Other operators include Consumers Co. of Chicago, Hales Corners Gravel Co., Hales Corners; Hartland Sand & Gravel Co., Hartland; Kohler Bros. Sand & Gravel, Northwest Sand & Gravel Co., and Valley Sand & Gravel Co., all of Waukesha; A. W. Nowatske,

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Mukwonago; C. Earl Rolefson, Oconomowoc; H. Turner & Son, Boscobel; and Vogt, Inc., Okauchee. Waukesha County Highway Department also produced sand and gravel.

Waupaca.—Hockers Brick Co., New London, and Brileen Co., Waupaca, produced clays for manufacturing building brick and other clay products. Clifford Coldwell, Waupaca, produced calcareous marl for agricultural use. C. H. Peters, Fremont, and Howard W. Waite, Clintonville, produced sand and gravel. The State highway commission purchased sand and gravel.

Waushara.—Calcareous marl for agricultural use was produced by Theodore Anderson, Wild Rose; Gaylord Dehling and William Edwards, Wautona; Elmer Bruck, Hancock; Leo Hendrickson, Redgranite; and Thomas Lundberg, Coloma. Lohrville Stone Co., Lohrville, produced rough and dressed dimension granite for buildings and monuments; it also produced broken granite for riprap. Weeks Sand & Gravel, Wautoma, and Waushara County Highway Commission produced sand and gravel.

Winnebago.—Crushed limestone for riprap, road construction, and agricultural and industrial uses was produced by Badger Highways Co., Inc., Menasha; Courtney & Plummer, Inc., Neenah; and the Lutz Co., Oshkosh. Badger Highways Co., Inc., also produced riprap. Sand and gravel for use in construction and railroad ballast was produced by Cook & Brown Lime Co. and Friedrich & Loots, Oshkosh; and Courtney & Plummer, Inc., and Schultz Sand & Gravel Co., Inc., Neenah. Winnebago County Highway Department produced sand.

Wood.—Dimension sandstone was produced by Ellis Stone Construction Co. and Felix Klesmith of Stevens Point. Alex Kauth Concrete Co., Wisconsin Rapids, produced paving sand.

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The Mineral Industry of Wyoming

By Frank J. Kelly,[1] William H. Kerns,[1] Breck Parker,[1] and Alfred L. Ransome[2]

This chapter has been prepared under a cooperative agreement for the collection of mineral data, except mineral fuels, between the Bureau of Mines, United States Department of the Interior, and the State Geological Survey of Wyoming.

THE VALUE of all minerals (excluding uranium) produced in Wyoming in 1954 reached a record total of $281.3 million and continued a trend that has been upward for many years.

The mineral industry in 1954 was characterized by substantial increases in the output of crude petroleum, trona, sand and gravel, and sulfur and in the value of iron ore produced. The year also witnessed another sharp drop in the output of coal and a continuation of the trend that has been downward since 1944.

Mineral fuels as a group continued to rank first in value of output, contributing 90 percent to the total value of the mineral wealth of Wyoming in 1954—the same as in 1953. Of the total value, which increased 10 percent over 1953, petroleum contributed 81, coal 4, clays 3, natural gas 2, natural-gas liquids 2, sulfur 1, sand and gravel 1, and other minerals 6 percent.

In 1954 Wyoming again ranked first in the United States in production of bentonite, byproduct elemental sulfur extracted from natural gas, and trona (hydrous sodium carbonate); sixth in petroleum; and eleventh in natural gas.

Activity in uranium prospecting, exploration, and mining continued unabated throughout the year. Enough productive capacity was developed to warrant construction of an Atomic Energy Commission buying station at Riverton.

The Government, through the Defense Minerals Exploration Administration (DMEA), continued to aid in financing exploration for strategic and critical minerals. Three contracts had been written in Wyoming since inception of the program, and one contract on iron ore was in force at the end of the year.

Some production data for 1954 were collected jointly with the Bureau of the Census, United States Department of Commerce. Production totals will be compared with the census totals when they are available and differences adjusted or explained. Bureau of Mines 1954 data in some instances are not directly comparable with those for 1953 because of differences in coverage.

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TABLE 1.—Mineral production in Wyoming, 1953–54 [1]

Mineral	1953		1954	
	Short tons (unless otherwise stated)	Value	Short tons (unless otherwise stated)	Value
Clays	852,651	$10,036,727	943,505	$9,534,087
Coal	5,244,572	23,743,996	2,831,430	11,541,312
Copper (recoverable content of ores, etc.)	1	574	1	590
Gold (recoverable content of ores, etc.) troy ounces	1	35	407	14,245
Gypsum	5,493	21,972	7,403	29,612
Iron ore (usable) long tons, gross weight	654,285	[2]	458,237	[2]
Natural gas million cubic feet	76,262	6,025,000	71,068	5,970,000
Natural-gas liquids:				
LP-gases thousand gallons	[2]	[2]	1,096	2,128,000
Natural gasoline do	[2]	[2]	1,121	3,137,000
Petroleum (crude) thousand 42-gallon barrels	82,618	195,800,000	93,533	229,160,000
Pumice and pumicite	648	1,898	[2]	[2]
Sand and gravel	3,149,376	2,001,197	4,163,660	2,681,527
Silver (recoverable content of ores, etc.) troy ounces	11	10	74	67
Stone	[3] 1,431,372	[3] 1,839,922	1,616,015	1,665,302
Sulfur, recovered elemental long tons	[2]	[2]	113,101	2,977,954
Vermiculite	403	2,418		
Undistributed: Cement, feldspar (1953), gem stones, manganiferous ore and concentrate (1953), phosphate rock, sodium carbonate, sodium sulfate, vanadium (1954), and minerals whose value must be concealed for particular years (indicated in appropriate column by footnote reference 2)		[4] 16,432,721		12,826,704
Total Wyoming		255,906,000		[5] 281,306,000

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers). Excludes uranium.
[2] Value included with "Undistributed."
[3] Excludes limestone for cement.
[4] Excludes clays for cement.
[5] Total adjusted to eliminate duplication in value of clays and stone.

TABLE 2.—Average prices of selected mineral commodities in Wyoming, 1953–54 [1]

Commodity	1953	1954
Clays short ton	$11.771	$10.105
Coal do	4.527	4.076
Copper [2] pound	.287	.295
Gold [3] troy ounce	35.000	35.000
Gypsum (crude) short ton	4.000	4.000
Natural gas M cubic feet	.079	.084
Petroleum (crude) [4] 42-gallon barrel	2.370	2.450
Sand and gravel short ton	.635	.644
Silver [5] troy ounce	.905+	.905+
Stone short ton	1.285	1.030

[1] Prices are based on average value f. o. b. mines or mills reported by the producers except as otherwise noted.
[2] Yearly average weighted price of all grades of primary metal sold by producers.
[3] Price under authority of Gold Reserve Act of Jan. 31, 1934.
[4] Value at wells.
[5] Treasury buying price for newly mined silver July 1, 1946, to date—$0.9050505 ($0.905 used in 1947 for calculating purposes).

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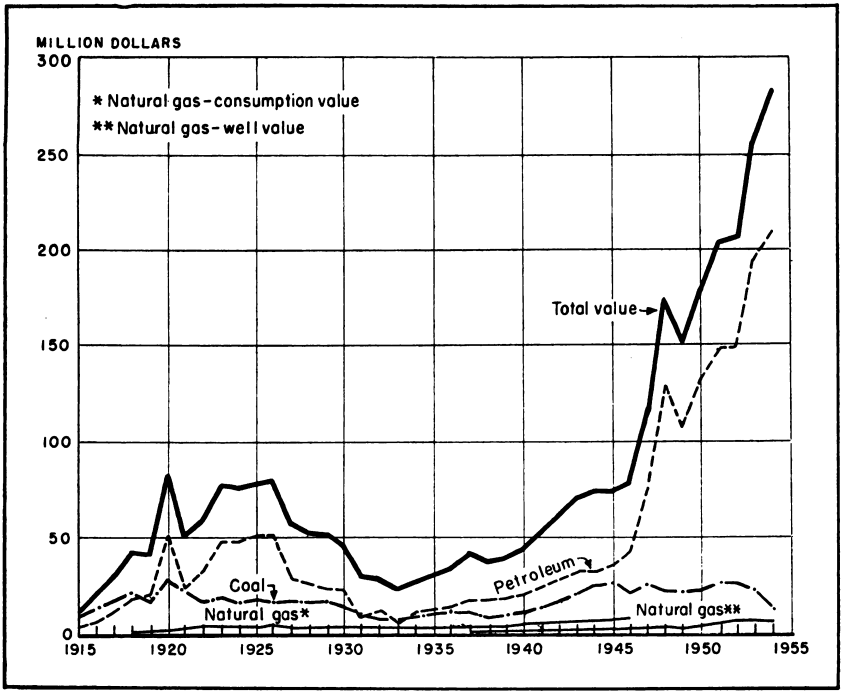

FIGURE 1.—Value of coal, petroleum, and natural gas and total value of all minerals produced in Wyoming, 1915–54.

REVIEW BY MINERAL COMMODITIES

METALS

Alumina.—Federal Bureau of Mines research at its experimental alumina plant at Laramie was completed in 1954. The plant (built during World War II by the Defense Plant Corp.) was used to test the feasibility of the soda-lime-sinter process for producing alumina suitable for producing aluminum metal from anorthosite and other aluminum silicate rocks.

Copper.—Production of 1 ton of copper from the State in 1954 came from a test shipment of ore from the Anderson Hawks Mining Co. mine, a new copper prospect being developed in Fremont County.

Gold.—Interest in gold in Wyoming increased during 1954, with new activity at two gold mines. Output jumped from 1 fine ounce in 1953 to 407 ounces in 1954. The Pioneer Carissa Gold Mines, Inc., mined 1,420 tons of ore from the Carissa mine and recovered 405 ounces of gold and 31 ounces of silver. The remaining 2 ounces of gold was recovered as a byproduct of copper output at the Anderson Hawks mine. The other gold-mining activity was at the Duncan mine, where Elayer & Co. conducted exploration and development and mill construction. The 2 gold mines and 1 copper mine are in Fremont County.

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TABLE 3.—Mine production of gold, silver, copper, and lead, 1945–49 (average), 1950–54, and total, 1867–1954, in terms of recoverable metals [1]

Year	Material sold or treated [2] (short tons)	Gold (lode and placer)		Silver (lode and placer)		Copper		Lead		Total value
		Fine ounces	Value	Fine ounces	Value	Short tons	Value	Short tons	Value	
1945–49 (average)	1,768	419	$14,679	37	$32	[3]	$65	1	$103	$14,879
1950										
1951	10	9	315	2	2					317
1952		1	35							35
1953	2	1	35	11	10	1	574			619
1954	1,445	407	14,245	74	67	1	590			14,902
1867–1954	[4]	80,449	1,924,043	74,906	51,991	16,328	5,685,536	14	1,486	7,663,056

[1] Includes recoverable metal content of gravel washed (placer operations), ore milled, and ore shipped directly to smelters during the calendar year indicated.
[2] Does not include gravel washed.
[3] Less than ½ ton.
[4] Figure not available.

Iron Ore.—The output (shipments) of iron ore from Wyoming dropped to 458,000 long tons in 1954 (nearly the same as in 1952) from 654,000 tons in 1953. The rate of production from year to year has depended on the demand for steel. Output came from the Sunrise mine, Colorado Fuel & Iron Corp., and tailings at the Good Fortune mine, Schroeder Mining Co., both in Platte County, The Sunrise mine and steel plant at Pueblo, Colo., have been operated by Colorado Fuel & Iron Corp. since 1900. The Schroeder Mining Co. reprocessed material from an old tailing dump in a heavy-medium plant constructed in 1954.

TABLE 4.—Shipments of iron ore, total 1900–49, and by years, 1950–54

Year	Long tons	Year	Long tons
1900–49	23,562,750	1952	484,945
1950	491,906	1953	654,285
1951	616,949	1954	458,237

Silver.—Silver output in 1954 was a byproduct of smelting copper ore from the Anderson Hawks mine and bullion and concentrate recovered from gold ore from the Carissa mine.

Titanium.—The extensive exploration program conducted for several years by the Union Pacific Railroad on the titaniferous magnetite deposits in the Iron Mountain area, in the Laramie Range northwest of Laramie, Albany County, was continued in 1954. The work included magnetometer, geologic, and geophysical surveys and diamond drilling. The exploratory work in 1953 and 1954 undoubtedly will add to ore reserves, but no new figures on estimated reserves have been reported to date. Laboratory research has indicated that titanium, iron, and vanadium can be extracted from the ores, but further study is necessary to determine the most feasible economic methods.

Uranium.—Uranium-mining activities were centered in Campbell, Crook, and Fremont Counties, with most of the activity concentrated in the Gas Hills and the newly discovered Crooks Gap-Green Moun-

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tain areas of Fremont County. Productive capacity was developed sufficiently during the year in the latter areas to warrant constructing an AEC buying station at Riverton. The plant was begun in November and was scheduled to open in the spring of 1955. Central Wyoming operators who previously shipped ore to Edgemont, S. Dak., or Rifle, Colo., were stockpiling where economically feasible in anticipation of the plant opening and to avoid shipments to distant points.

NONMETALS

Cement.—The Laramie cement plant, Monolith Portland Midwest Co., continued to be the only facility producing cement in the State. The construction boom in the Rocky Mountain States affected the industry, and the demand for cement continued upward. Shipments of types I, II, and III, high-sulfate-resistant, oil-well, and masonry cement jumped 19 percent above the record established in 1953. Employment also increased; the average employment was 154 men for 365 days in quarrying, crushing, and cement-mill operations.

Clays.—Bentonite continued to be the most important nonmetal in Wyoming and was third in terms of value of output in the State. Wyoming again ranked first in the United States in the production of bentonite, and sales in 1954 increased 11 percent over 1953 owing to a gain in the demand for industrial and chemical uses. The bulk of the output in 1954 was used as a conditioning agent for oil-well-drilling mud. Sales also were reported for uses in foundry molds, as a concrete admixture, in manufacturing insecticides and fungicides, and in animal feeds, briquet binder, emulsions, detergents, ceramics, and other chemical uses. The average price reported by producers declined from $14.70 a ton in 1953 to $12.58 in 1954. This drop does not reflect the lowering of price to compete with substitutes but rather economy in size of operation due to large-scale mining and processing operations and expanding markets. Production and output reached the highest level in the history of the State in 1954, and the demand for Wyoming bentonite as a product of good, controlled quality remained high.

TABLE 5.—Shipments of bentonite, 1945–49 (average) and 1950–54

Year	Short tons	Value	Year	Short tons	Value
1945–49 (average)	281,073	$2,699,660	1952	692,853	$9,168,708
1950	394,939	4,091,571	1953	670,756	9,861,321
1951	465,254	5,981,655	1954	742,453	9,339,755

Crook was the major producing county, followed by Weston, Big Horn, Natrona, and Johnson. The eight producing companies in 1954, in order of output, were: Baroid Sales Division, National Lead Co., Crook and Weston Counties; Magnet Cove Barium Corp., Big Horn County; Wyodak Chemical Division, Federal Foundry Supply Co., and American Colloid Co., both in Weston County; Eastern Clay Products Department, International Minerals & Chemical Corp., and Black Hills Bentonite, Inc., both in Crook County; Wyo-Ben Products Co., Big Horn County; and Benton Clay Co. mines and processing plant in Johnson and Natrona Counties. The

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8 mine-operating companies employed an average of 70 men for 154 to 305 days, and an average of 192 men worked 265 to 312 days at the various grinding plants.

Miscellaneous-clay mining played only a small part in the clay industry of the State. Most of the clay was produced in Albany County by Monolith Portland Midwest Co. for use in manufacturing cement. Small quantities of miscellaneous clay also were produced by Lovell Clay Products Co. and Sheridan Pressed Brick & Tile Co. for manufacturing building brick and other structural clay products for local consumption.

Gem Stones.—Wyoming was one of the principal producers of gem stones in the United States; sales of gem and ornamental stones consisted mainly of jade, agate, petrified wood, and obsidian. Fremont and Sweetwater Counties were the major producing areas.

Gypsum.—Again in 1954, gypsum mined by the Wyoming Construction Co. in Albany County and used in manufacturing cement supplied the bulk of the output of this mineral commodity. However, during the year a new company, operating in Park County, reported sales of a small quantity of agricultural gypsum.

Phosphate Rock.—Phosphate rock was mined at the Leefe mine, San Francisco Chemical Co., 2½ miles northwest of Sage, Lincoln County. The output was used as direct-application fertilizer and stock and poultry feed and in manufacturing superphosphate, triple superphosphate, and phosphoric acid for metallurgical purposes. Production declined substantially owing to gradual exhaustion of minable material and also as a result of the time and effort expended in mine development and in installing new processing facilities. During 1954 San Francisco Chemical Co. began mining operations in Utah, and the crude phosphate rock was shipped to Wyoming for processing. This additional tonnage of mill feed was handled in the new two-stage dry-separation facility completed by the company in 1953.

Pumice and Pumicite.—The output of pumice and scoria increased substantially in 1954, mainly owing to two new producers. In addition to Superior Pumice Co., which has been operating for a number of years in Sweetwater County, the production of scoria for railroad ballast was reported by Tongue River Stone Co. and Sheridan Wyoming Coal Co., both in Sheridan County.

Sand and Gravel.—The total output of sand and gravel continued its upward trend and increased 32 percent in 1954, compared with a 30-percent gain reported in 1953. Washed, screened, or otherwise prepared materials comprised 90 percent of the total production in 1954. Of the 4.2 million tons produced, 2.8 million tons was produced by private contractors and sold to local consumers or shipped to Government agencies engaged in highway work; and 1.4 million tons was produced by Government maintenance crews and project contractors. The largest individual producer was Alfred E. Matheson; other important operators included Big Horn Construction Co., Taggart Construction Co., Knisely-Moore Co., and Platte Valley Construction Co.

Sodium Compounds.—Wyoming ranked first in the United States in the production of trona (natural sodium carbonate), and the record output in 1954 more than doubled 1953 sales. The entire output

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came from a mine and plant of Intermountain Chemical Co., near Green River, Sweetwater County. The industry has developed extensively since 1948, and the output of soda ash continued to increase to keep pace with the rising demand by the chemical industry.

Wyoming also had two sodium sulfate operations in Carbon and Natrona Counties, which were being developed and worked by Iowa Soda Products Co. and William E. Pratt. The output in 1954 was 70 percent over 1953, compared with a 30-percent decrease in 1953. The continued growth of this segment of the mineral industry also resulted from the increased demand for sodium sulfate and other sodium compounds by the Nation's chemical industry.

Stone.—The production of various types of stone in Wyoming provided an important part of the income to the mineral industry of the State, as well as employment for a considerable proportion of its labor force.

Crushed limestone was the most important stone in terms of quantity and value; it furnished 67 percent of the total stone tonnage and 74 percent of the total value. The limstone was used for many purposes, but the bulk was consumed by the construction industry. The major uses were for concrete aggregate, railroad ballast, cement, and riprap, but significant quantities of limestone were used in refining sugar and as a mineral food, fluxing medium, and soil conditioner.

Crushed granite for railroad ballast and concrete aggregate was the second-ranking stone in quantity, followed by crushed sandstone and crushed miscellaneous stone. No dimension stone was reported in 1954. The 6 leading producers of stone, who together produced 86 percent of the State total, were, in order of output, Morrison-Knudsen Co., Inc., Laramie County; Guernsey Stone Co., Platte County; Taggart Construction Co., Park County; Great Western Sugar Co., Laramie County; Monolith Portland Midwest Co., Albany County; and Boatright & Smith, Carbon County.

Sulfur.—The byproduct recovery of sulfur from natural gas in Wyoming, which began in 1948, has reached the point where it is an important factor in the growth of the mineral industry of the State. Output in 1954 reached 113,000 long tons valued at nearly $3 million. Productive activity in 1954 was centered in the north-central and northwestern part of the State. The Texas Gulf Sulphur Co., the first producer in the State, operated its Worland plant throughout the year, and the Elk Basin plant of Stanolind Oil & Gas Co. was also in continuous operation. The most important factor affecting an overall increase in output in 1954 was the full-year operation of the new Silvertip sulfur plant of the Seaboard Oil Co. of Delaware, near Powell, Park County. This 50-ton-per-day facility, placed in operation in May 1953, processes sour natural gas from the Silvertip and other fields.

MINERAL FUELS

Coal.—Curtailed production and closed mines characterized Wyoming's coal industry in 1954 as production fell to 2.8 million tons, 54 percent of the 1953 output.

Four mines closed during 1954—mines that produced 20 percent of the State output in 1953. Union Pacific Coal Co., by far the largest

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producer in the State, closed 3 of its 6 operations in Sweetwater and Carbon Counties; and Colony Coal Co. shut down 1 of its 3 mines in Sweetwater County.

Cutbacks in production were numerous and considerably more severe in mines producing more than 100,000 tons annually than in smaller mines. In the larger mines production was curtailed roughly 30 percent; in the smaller ones only 10 percent. Output from many of the mines that produced less than 100,000 tons increased in 1954.

TABLE 6.—Production of coal, 1953–54, by counties, in net tons

County	1953		1954	
	Production (short tons)	Average value per ton [1]	Production (short tons)	Average value per ton [1]
Campbell	320,654	$1.36	(2)	(2)
Carbon	736,478	5.57	233,200	$3.57
Converse	6,908	3.13	(2)	(2)
Fremont	3,042	6.48	(2)	(2)
Hot Springs	12,542	7.71	(2)	(2)
Johnson	1,453	4.00	(2)	(2)
Lincoln	617,874	2.97	(2)	(2)
Sheridan	535,446	3.21	(2)	(2)
Sublette	1,000	6.21		
Sweetwater	3,009,175	5.15	1,276,302	5.61
Other counties			1,321,928	2.69
Total	5,244,572	4.53	2,831,430	4.08

[1] Value received or charged for coal f. o. b. mine, including selling cost. Includes value for coal not sold but used by producer, such as mine fuel and coal coked, as estimated by producer at average prices that might have been received if such coal had been sold commercially.

[2] Included with "Other counties."

Conversion from coal-fired to diesel locomotives and residential and commercial heating by natural gas and liquefied-petroleum gases continued to cut Wyoming's coal markets, as in previous years. A slackening of industrial activity and a consequent reduction of railroad-freight haulage, off 8–10 percent on a nationwide basis, were probably more responsible for the steeper drop in 1954. Utilization of coal by railroads has been one of the major outlets for Wyoming coal in the past. During the period of declining traffic, coal-fired locomotives were the first to be placed on standby use because of higher operating costs compared with diesels. The effect on coal consumption therefore may be magnified several times over the actual reduction in traffic. In addition, coal was consumed more efficiently owing to less congestion of traffic on the lines, which further reduced the total consumption. In 1954 mines in Sublette, Uintah, and Park Counties producing less than 1,000 tons of coal each were active. Output from these mines is excluded from State and national production totals.

Natural Gas.—Marketed production of natural gas fell from 76 billion cubic feet in 1953 to 71 billion in 1954, although the value decreased only slightly, as the average wellhead price rose from 7.9 to 8.4 cents per thousand cubic feet. Consumption within the State (half of the marketed production) remained at the 1953 level; slight upward shifts in residential, commercial, and field use, plus refinery consumption (up 25 percent), were offset by decreases in use by utilities (off 11 percent) and other industrial consumers (off 23 percent).

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A decrease in out-of-State transmissions (the other half of the marketed production) due to less industrial activity in other areas of natural gas was the main cause for the decline.

During the year the Federal Power Commission approved application for construction of two natural-gas pipelines through Wyoming: The first, the Pacific Northwest pipeline, to carry gas from the San Juan basin of New Mexico northward along the Utah-Colorado border, through southwestern Wyoming, thence across southern Idaho into the Pacific Northwest area; the second line, planned by the Colorado Interstate Gas Co., to connect to the first near Rock Springs and carry gas across southern Wyoming and thence south into the Denver, Colo., area. Both transmission lines would give added outlets to the productive capacity of Wyoming's Green River basin, and exploration in the area was stimulated.

Natural-Gas Liquids.—Production of liquefied-petroleum gases (propane and butane) increased 15 percent in 1954 over 1953, and little change was reported in production of natural gasoline. Seven plants recovering natural-gas liquids were reported active at the beginning of the year, with total daily capacities of 1,791 barrels of propane, 1,629 barrels of butane, and 4,768 barrels of natural gasoline and other products. The natural-gas-liquid industry employed approximately 300 men and recovered a product valued at $5,265,000 in 1954.

Petroleum.—Production of petroleum rose to 93.5 million barrels in 1954, a 13-percent increase over 1953. Production data for 20 of the 150 fields in the State are shown in table 7.

Exploration drilling increased 40 percent and development drilling 30 percent over 1953; 271 and 950, holes respectively, were drilled, with a wildcat success ratio of 1:5.2.

Drilling was concentrated mainly in the Clareton area of Weston County. Development wells numbered 500 and furnished 41 percent of the State total. Exploration drilling in Weston and neighboring Niobrara County totaled an additional 57 holes, of which 21 were successful oil discoveries.

The average costs of drilling and equipping a well in Wyoming in 1954 were as follows: 5,510-foot oil well, $69,600; 5,765-foot gas well, $143,800; and 5,130-foot dry hole (includes some service wells), $72,300.[3] Costs exclude taxes, interest on investments, overhead, and value of material after salvage. They include cost of labor, supplies, water, fuel, and power used in such operations as erecting and dismantling rigs and derricks, drilling holes, running and cementing casing, hauling materials, and installing equipment; machinery and tool charges or rentals; delivered and installed cost of equipment such as tubing, wellhead fittings, gas traps, flow tanks, and drilling or special-production derrick; the amount obligated to contractors for any of the above materials, equipment, or services where supplied by contractors; and the cost of salvaging any material for reuse.

A possible explanation for contrasting cost data is the degree of geographic concentration that characterized drilling for the year. Weston County, for example, had 443 (54 percent) of the 818 oil wells in the State but only 76 (20 percent) of the 374 dry holes that were drilled. Aside from possible differences in drilling costs in

[3] Bureau of Census, 1954 Census of Mineral Industries (Preliminary Report), Crude Petroleum and Natural Gas: Series MI-13-1, October 1956, 14 pp.

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different areas and under varying conditions, concentration itself leads to substantially lower drilling costs owing to greater competition and shorter travel time between holes. Such economy applies to oil wells more than to dry holes.

TABLE 7.—Production of crude petroleum, 1953–54, by fields, in thousand barrels

Field	1953	1954	Field	1953	1954
Beaver Creek	605	726	Lance Creek	1,662	1,937
Big Muddy	1,373	1,088	Little Buffalo	1,142	1,224
Big Sand Draw	2,400	2,503	Lost Soldier-Wertz, etc.	5,900	6,519
Bonanza	2,935	3,536	Oregon Basin	3,508	4,898
Byron-Garland	5,603	6,642	Salt Creek	4,375	4,583
Coal Creek-Northeast and South	2,271	1,506	Steamboat Butte	3,611	3,443
Elk Basin	8,488	6,889	Sussex-Meadow Creek	4,022	6,802
Frannie	3,731	3,708	Winkleman	1,255	1,414
Gebo	888	698	Other fields [1]	17,511	23,344
Glenrock-South	4,197	3,940	Total	82,618	93,533
Grass Creek	3,583	4,367			
Hamilton Dome	3,558	3,766			

[1] Includes crude oil consumed on leases and net change in stocks held on leases for entire State.

TABLE 8.—Wildcat and development completions in 1954, by counties

[Oil and Gas Journal]

County	Oil	Gas	Dry	Total	Footage
Wildcat completions:					
Big Horn	2		10	12	57,400
Campbell	1		1	2	15,800
Carbon	1	4	15	20	103,800
Converse	1		13	14	92,400
Crook			9	9	15,600
Fremont	5	1	18	24	142,700
Goshen			2	2	12,100
Hot Springs		1	12	13	60,800
Johnson			5	5	22,200
Laramie			6	6	45,800
Lincoln			4	4	26,200
Natrona	5		33	38	153,900
Niobrara	14		24	38	234,000
Park	3		9	12	77,900
Platte			2	2	2,300
Sheridan	1		10	11	58,400
Sublette	1	2	7	10	61,500
Sweetwater		2	8	10	74,600
Teton			2	2	12,100
Uinta			3	3	12,200
Washakie	1		14	15	109,200
Weston	7		12	19	112,400
Total wildcats	42	10	219	271	1,503,300
Development completions:					
Big Horn	19		4	23	107,500
Carbon	2	1		3	14,900
Converse	42		15	57	363,300
Fremont	38		3	41	159,000
Hot Springs	74		16	90	360,100
Johnson	70	3	15	88	252,500
Lincoln			1	1	2,100
Natrona	57		14	71	250,900
Niobrara	11		2	13	82,400
Park	7	3	9	19	84,000
Sheridan	14		3	17	80,800
Sublette		7	5	12	33,000
Sweetwater		5	1	6	43,300
Uinta			1	1	700
Washakie	6		2	8	58,100
Weston	436		64	500	3,140,800
Total developments	776	19	155	950	5,033,400
Total all drilling	818	29	374	1,221	6,536,700

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TABLE 9.—Capacity of petroleum refineries and cracking plants as of Dec. 31, 1954

(Barrels per day)

Company	City and county	Type of plant	Crude-oil capacity, operating	Cracked-gasoline capacity, operating
C & H Refinery	Lusk, Niobrara	Skimming	160	
Continental Oil Co	Glenrock, Converse	Skimming, cracking	3,400	990
Empire State Oil Co	Thermopolis, Hot Springs.	Skimming	5,000	
Frontier Refining Co	Cheyenne, Laramie	Skimming, cracking, asphalt.	14,500	5,400
Husky Oil Co	Cody, Park	do	5,500	1,000
Independent Refinery	Lusk, Niobrara	Skimming	[1] 80	
Ohio Oil Co	Lovell, Big Horn	Skimming, cracking, asphalt.	6,000	150
Pilot Oil Co	Morton, Fremont	Skimming	[1] 200	
Sinclair Refining Co	Sinclair, Carbon	Skimming, cracking	25,000	8,700
Sioux Oil Co	Newcastle, Weston	do	[2] 4,000	[2] 2,250
Socony-Vacuum Oil Co., Inc.	Casper, Natrona	Skimming, cracking, asphalt.	8,000	2,250
Standard Oil Co. (Ind.)	do	Complete	19,200	8,210
The Texas Co	do	Skimming, cracking, asphalt.	17,000	5,500
Total			108,040	34,450

[1] Shut down.
[2] In addition, 1,000 barrels per day, building.
[3] In addition, 500 barrels per day, building.

Two pipelines underwent construction in 1954: The Platte pipeline was expanded, doubling its capacity to transport crude petroleum to 190,000 barrels per day; and the Western Pipe Line Co. (a subsidiary of Service Pipe Line Co.) completed construction of a 22-inch crude line from Fort Laramie, Goshen County, to Kansas City, Mo.

REVIEW BY COUNTIES

Albany.—Cement produced by the Monolith Portland Midwest Co. at Laramie supplied the bulk of the value of mineral output of Albany County in 1954, and the nonmetals as a group comprised the total value of mineral production in the State.

The wet-process cement plant at Laramie was operated for 345 days and employed 95 men in 1954. The company also employed 24 men for 365 days to quarry and prepare limestone and miscellaneous clay for the manufacturing process. The sand-and-gravel output consisted mainly of commercial-structural and paving sand and gravel used by the building trades. The Wyoming Highway Department let contracts for highway construction and maintenance, which resulted in production of 12,700 tons of paving gravel. Coupled with the demand for cement, production and sales of gypsum by the Wyoming Construction Co. increased from 5,500 tons in 1953 to 7,000 tons in 1954. This open-pit operation employed 6 men for 55 days during the year.

None of the metal mines in the county that produced small quantities of manganiferous ore, copper, and silver in 1953 were active in 1954. The Bureau of Mines completed its work at the Government experimental alumina plant at Laramie in 1954; tests were made to determine the feasibility of producing alumina from anorthosite and other silicate rocks in the vicinity. Exploration conducted each

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TABLE 10.—Value of mineral production in Wyoming, 1953–54, by counties [1]

County	1953	1954	Minerals produced in 1954 in order of value
Albany	(2)	$3,298,632	Cement, clays, stone, sand and gravel, gypsum.
Big Horn	$2,040,907	2,298,970	Clays, sand and gravel.
Campbell	493,725	480,023	Coal, sand and gravel.
Carbon	4,249,811	1,144,040	Coal, sand and gravel, stone, sodium sulfate.
Converse	104,895	106,223	Sand and gravel, coal, stone.
Crook	4,447,308	4,190,486	Clays, sand and gravel.
Fremont	270,638	290,444	Sand and gravel, coal, gold, stone, copper, silver.
Goshen	53,238	49,202	Sand and gravel, stone.
Hot Springs	175,102	142,160	Coal, sand and gravel, stone.
Johnson	[4] 83,020	148,150	Clays, sand and gravel, coal.
Laramie	1,141,842	973,510	Stone, sand and gravel.
Lincoln	3,208,411	2,422,846	Coal, phosphate rock, sand and gravel, stone.
Natrona	322,183	571,902	Sand and gravel, clays, sodium sulfate, stone.
Niobrara	62,323	90,781	Sand and gravel.
Park	631,281	1,045,260	Sulfur, sand and gravel, stone, gypsum.
Platte	(3)	3,372,382	Iron ore, stone, sand and gravel.
Sheridan	1,922,749	1,673,457	Coal, pumice and pumicite, sand and gravel stone, clays.
Sublette	64,995	10,040	Sand and gravel.
Sweetwater	18,648,316	13,512,922	Coal, sodium carbonate, sand and gravel, stone, pumice and pumicite.
Teton	50,990	127,100	Sand and gravel, stone.
Uinta	68,103	51,070	Sand and gravel.
Washakie	(3)	2,251,377	Sulfur, sand and gravel.
Weston	3,410,914	2,863,660	Clays, sand and gravel, stone.
Yellowstone Park	(3)	21,700	Sand and gravel.
Undistributed	[5][6] 214,455,719	240,530,063	
Total	255,906,000	[7] 281,306,000	

[1] Value data of gem stones, natural gas, natural-gas liquids, petroleum, some sand and gravel (1954), and vanadium (1954) are excluded from county totals and included with "Undistributed" to avoid disclosure of individual company operations.
[2] Value of uranium ore is excluded.
[3] Value included with "Undistributed" to avoid disclosure of individual company operations.
[4] Value of bentonite in Johnson County included in value for Natrona County.
[5] Revised figure.
[6] Excludes value of clays used for cement.
[7] Total has been adjusted to eliminate duplication in value of clays and stone.

year since 1951 by the Union Pacific Railroad Co. on the titaniferous magnetite deposits in Iron Mountain was continued in 1954.

Big Horn.—Although petroleum furnished the major portion of the value of mineral production in the county during 1954, Big Horn County was a major producer of bentonite. Magnet Cove Barium Corp. operated its open pit and grinding plant northeast of Greybull throughout the year and had greater production than in 1953. Wyo-Ben Products Co., the only other producer of bentonite in the county, was also active in 1954. Shipments of ground bentonite were made to consumers throughout the United States to be used in rotary-drilling mud, foundries, and the chemical industry. Miscellaneous clay was quarried by the Lovell Clay Products Co.; it employed 1 man for 201 days for the mining operation. All raw clay was shipped to the company brick plant and used in manufacturing building brick and other structural clay products.

A major mineral-industry development in Big Horn County was announced by Socony Vacuum Co.—construction of a sulfur plant near Manderson. Leveling for the plant site was begun in May by a Los Angeles construction company. It was estimated that $800,000 would be spent during the year on erection of the natural-gas and sulfur plants, eventually to cost $2 million. The Pegasus Division, Socony Vacuum Co., will purchase the gas plant; and Jefferson Lake Sulphur Co., of New Orleans, will own the sulfur facility.

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Campbell.—The Wyo-Dak Coal Co. continued to operate its strip mine near Gillette throughout the year. The mine employed 38 men for 306 days (4 men and 2 days less than in 1953). Production did not decline as in other coal mines and was within 2 percent of the 1953 output.

Uranium ore was mined from the Wasatch formation in the Pumpkin Buttes area by Kerr-McGee Oil Industries, Inc., which also did exploratory drilling in conjunction with Jenkins & Hand.

Carbon.—Coal continued to rank first in total value among the minerals produced in the county during 1954. Coal output fell to 32 percent of the 1953 level after the Hanna No. 4A mine closed, and operations at the Nugget Strip mine were cut.

In February 1954, the Union Pacific Coal Co. closed the Hanna No. 4A mine, which in 1953 employed 213 men for 215 days and produced 440,000 tons of coal.

Nugget Coal & Timber Co. became the county's largest producer after the Hanna No. 4A closed but operated at only half the 1953 figure; employment dropped from 39 to 15 men and days worked from 274 to 239.

The Hanna No. 2 strip mine, Monolith Portland Midwest Co., and the Thomas mine, Thomas Coal Co., operated within 6 percent of the 1953 figure.

Sand and gravel produced by private contractors for the State highway department and commercial producers was second in value of output; and crushed limestone, quarried by Boatright & Smith Construction Co. for concrete, ranked third. Sodium sulfate was recovered from the Bull Lake region north of Rawlins by Iowa Soda Products Co.

Nugget Coal & Timber Co. made test shipments of material from a uraninite-molybdenite deposit found in Precambrian rocks of the Pedro Mountains. Elsewhere, uranium occurrences were reported in the Morrison formation of the Shirley Mountains and in the Browns Park formation near Baggs.

Crook.—Crook County ranked first in Wyoming in the production and sale of bentonite in 1954, and output increased 14 percent over 1953. The major producers in order of importance were: Baroid Sales Division, National Lead Co.; Eastern Clay Products Department, International Minerals & Chemical Corp.; Wyodak Chemical Division, Federal Foundry Supply Co.; and Black Hills Bentonite Co.

Paving gravel, used in the construction and maintenance of State highways, was produced.

Shipments of uranium ore were made from deposits in the Lakota and Dakota sandstones of the western Black Hills. Three of the operators active in the area were the Homestake Mining Co., near Carlile and New Haven; Little Mo Mining Co., west of New Haven; and Rounds & Shirmer, north of Devils Tower.

Fremont.—Nonmetals continued to be the major source of income to the mineral industry of the county, and output consisted mainly of sand and gravel and stone used for road construction.

As a result of 2 months of development work at the Anderson Hawks mine, a new copper prospect in 1954 (the Anderson Hawks Mining Co.) made a 25-ton test shipment of ore (containing 1 ton of copper and small quantities of gold and silver) to the American Smelting & Refining

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Co. smelter at Garfield. Activity from July through December 1954 at the Carissa mine near Atlantic City by Pioneer Carissa Gold Mines, Inc., resulted in the mining and milling of 1,420 tons of ore, from which 405 fine ounces of gold and 31 ounces of silver were recovered. Elayer & Co. spent the first 3 months of 1954 on development and exploration work at its Duncan gold mine and the remainder of the year constructing its ore-treating mill.

Active uranium prospecting in 1954 brought to light several new areas of interest; the Crooks Gap-Green Mountain area appeared most promising. Shipments from this area were made from the Sno-Ball mine by Coke River Development Co. The Gas Hills area, discovered late in 1953 by Neil McNiece, was developed rapidly in 1954, with emphasis on land acquisition and drilling. Shipments were made by Lucky Mc Uranium Corp. (largest producer in the district), Green River Oil & Uranium Co., Mountain Mesa Uranium Co., Sateco Uranium Co., and Vitro Uranium Corp. Ore was shipped to Rifle, Colo., and Edgemont, S. Dak., but considerable ore was stockpiled, pending construction of an AEC buying station at Riverton. One of the major problems of the Gas Hills producers, in addition to long-distance haulage, was accurate determination of grade. Radiometric assays gave results that were both high and inconsistent compared with chemical analyses; subsequently, numerous shipments of subgrade material were made.

Goshen.—Private contractors working for the county and State highway departments and the Federal Bureau of Reclamation produced paving sand and gravel valued at $36,000 and crushed miscellaneous stone used in constructing and maintaining highways.

Hot Springs.—Except for a small quantity of structural and paving sand and gravel sold locally, all output of this commodity was produced under contract with the Wyoming Highway Department and used in constructing and maintaining State highways.

Crushed agricultural limestone, the only stone reported in 1954, was produced by Wyomite Co.

Johnson.—Bentonite, mined by the Benton Clay Co. and shipped to its Casper grinding plant, and paving gravel, produced as a result of highway contracts, represented the entire output of minerals in Johnson County during 1954; output of both commodities increased substantially over 1953.

Laramie.—Crushed limestone and granite and paving gravel comprised the output of mineral commodities produced in Laramie County in 1954. The Horse Creek underground limestone mine, northwest of Cheyenne (Great Western Sugar Co.), operated throughout the year; and, with the exception of 29,000 tons produced by Read Construction Co., furnished all the output of this stone in the region. It was used principally in refining sugar, but significant tonnages were sold for use as a fluxing medium and as riprap and concrete aggregate in road construction, for railroad ballast, and in mineral food.

Lincoln.—The 1954 output of coal (the county's major commodity) fell to 89 percent of the 1953 production, and cutbacks were common to the 3 operating mines. The Elkol strip and Brilliant No. 8 mines, near Elkol and Frontier, were operated by Kemmerer Coal Co., which produced all but a few thousand tons of the county output. Near Alpine, the Blind Bull Coal Co. operated the Blind Bull mine.

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During 1954 Kemmerer conducted experimental work on high-temperature carbonization, a process that removes moisture, gas, and coal tar to produce a relatively pure, high-carbon material suitable for some metallurgical and chemical uses.

San Francisco Chemical Co., operating the Leefe open-pit mine, was again the only Wyoming producer of phosphate rock in 1954; Phosphate Mines, Inc., of Kemmerer, was idle. Sales of crude and processed rock declined considerably in 1954 owing to the gradual exhaustion of presently minable deposits. The company employed 16 men in mining operations and 25 men at the beneficiation plant.

Paving gravel for highway construction and maintenance was produced by Big Horn Construction Co., W. W. Clyde Co., Larson-Meyer Construction Co., Platte Valley Construction Co., and State highway department crews. Big Horn Construction Co. also quarried 24,000 tons of crushed limestone, which was used in highway construction and maintenance.

Natrona.—Sand and gravel was the most important mineral, in terms of value; of the 534,000 tons produced, 185,000 tons was classed as commercial output and sold to the local building trades, mainly in and around Casper.

Bentonite was the second most important mineral, in terms of value; Benton Clay Co. continued to receive and process crude bentonite from its mines in the vicinity of Kaycee, Johnson County, and Casper, Natrona County. The mill output of ground material remained relatively the same as in 1953. Shipments were made to consumers for use in rotary-drilling mud and the chemical industry.

Glauber's salt, one of the sodium sulfate minerals, was produced by William E. Pratt from an open-pit saline deposit near Casper. Crushed sandstone and limestone were quarried in Natrona County for highway projects by a number of private contractors and construction crews of the county road and bridge department.

Park.—Output of the mineral industry of Park County consisted of sulfur, sand and gravel, stone, and gypsum; and the value of mineral production for the county increased to $1 million in 1954, compared with $632,000 in 1953.

Elemental sulfur recovered in the liquid purification of sour natural gas ranked first in value of sales of nonmetals. The new Silvertip plant, Seaboard Oil Co. of Delaware, increased its output during 1954 and was mainly responsible for the 36-percent gain in output, Stanolind Oil & Gas Co. continued to operate its Elk Basin facility and is credited with sustaining production of this mineral commodity in the county.

Production and use of paving gravel jumped from 238,000 tons in 1953 to 367,000 tons in 1954 and resulted from increased highway construction activity in the region. In addition to sand and gravel, crushed limestone was quarried by Taggart Construction Co. for the same purpose. A new company began mining, processing, and selling agricultural gypsum in 1954; but after limited operation, activity ceased.

Platte.—Iron ore, stone, and sand and gravel, in order of importance, were produced in Platte County in 1954. The only two producers of iron ore and concentrate in the State were both in Platte County.

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Colorado Fuel & Iron Corp. continued to mine iron ore (hematite) from its Sunrise mine and to ship the ore directly to its plant at Pueblo, Colo., for the production of steel. Three hundred men were employed at the Sunrise mine, which originally was an open-pit operation and until 1942 was considered to be the deepest open-pit operation in the world. The pit was abandoned later, and all operations in 1954 were underground. Schroeder Mining Co. processed material from the old tailing dump at the Good Fortune mine 1½ miles southeast of Guernsey in a newly constructed heavy-medium separation plant to produce a marketable iron ore (concentrate). The operation was active in 1954 until September 18, when it was closed for the winter months.

The output of crushed limestone (dolomite) for railroad ballast, concrete aggregate, and riprap from the Guernsey quarry, Guernsey Stone Co., dropped considerably in 1954 owing to a decline in the demand for railroad ballast. Employment in quarrying and crushing operations fell from 37 men in 1953 to 16 in 1954. All production of sand and gravel reported in 1954 resulted in contracts let by the State highway department, and all output was used in the construction and maintenance of roads.

Sheridan.—Coal was again the most important commodity produced in Sheridan County and furnished 82 percent of the total county value, compared with 92 percent in 1953. The decline can be attributed mainly to the increased production and sale of scoria by Tongue River Stone Co. and Sheridan Wyoming Coal Co. for railroad ballast.

Coal was produced from 5 operations; the Big Horn Strip mine, Big Horn Coal Co., was the largest and produced over 90 percent of the county total. County production for the year was 19 percent lower than in 1953 owing [primarily to the closing of the Monarch mine by Sheridan Wyoming Coal Co. in 1953. Three of the county producers—Welch Coal Co., Storm King Coal Co. which operates 2 mines, and Custer Coal Co.—showed production increases in 1954.

Highway construction and repair in 1954 remained relatively stable; subsequently, production of sand and gravel by private contractors and highway-department crews remained the same as in 1953.

Sheridan Pressed Brick & Tile Co. produced 556 tons of miscellaneous clay in 1954, which was consumed in manufacturing building brick and other structural clay products at its Sheridan brick plant.

Sweetwater.—Sweetwater County remained the leading producer of coal in the State in 1954 and felt most strongly the loss of coal markets through a 58-percent decline in production.

The Reliance Nos. 7 and 11 mines, Union Pacific Coal Co., were closed January 31; at the end of March the Colony Coal Co. closed the Dines mine. These companies were the county's major producers. They continued to operate their other mines—Stansbury, Superior, D. O. Clark, and Rock Springs No. 8 of Union Pacific and Peacock and Nugget No. 2 strip of Colony. The Kleen-Fyre mine, Rock Springs Fuel Co., was idle throughout the year. Two other operators, Gunn-Quealy Fuel Co. and Swanson Mining Co., were exceptional in that they increased their output substantially.

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Coal-mine employment in the county dropped from 1,880 men in 1953 to half that figure in 1954, reducing the average number of days worked.

Trona mined by Intermountain Chemical Co. was the most important nonmetal produced in Sweetwater County in 1954. Sales of soda ash produced at the company chemical plant, 15 miles northwest of Green River, more than doubled the 1953 figure. Processing-facility and mine-expansion programs were continued: Underground workings were expanded, and belt conveyors extended and relocated; the surface-crushing system was enlarged; and electric jeeps, man-trip trailers, and material trailers were added. According to the State Inspector of Coal Mines, an average of 494,479 tons of trona was mined in 1954, and 324 men were employed in all operations.

Construction materials provided the remainder of the value of mineral production in the county. Pumice for lightweight aggregate was produced by Superior Pumice Co. and sand and gravel by commercial producers for local consumption and private contractors for the State and county.

Washakie.—The production of elemental sulfur was the major source of employment and income to the mineral industry of Washakie County, an otherwise agricultural area. Texas Gulf Sulphur Co. operated its Worland plant on hydrogen-sulfide gas produced by Pure Oil Co. in the Worland oil field. This segment of the mineral industry will be augmented by construction of two small sulfur-processing facilities at the Neiber Dome and Stockham-Federal fields near Worland by Signal Oil & Gas Co., of Los Angeles. Work will begin in 1954 first on the Stockham-Federal plant; both plants are expected to be completed late in 1955 or early 1956. Contracts let by the State highway department and Federal Bureau of Public Roads induced some paving-gravel production, and one commercial operator reported local sales of structural sand and gravel.

Weston.—The output of bentonite in Weston County increased 2 percent in 1954, and the bentonite sales furnished 97 percent of the total value of mineral production in the county. The three producing companies—Wyodak Chemical Division, Federal Foundry Supply Co., with a mill at Upton; Bariod Sales Division, National Lead Co., with mines near Osage and a mill at Clay Spur; and American Colloid Co., with a mine and mill near Upton—employed an average of 13 men for 275 days in mining operations and 84 men for 295 days at their mills. Sand and gravel and crushed limestone used in the construction and maintenance of State roads supplied the remainder of the total value of all minerals produced in the county.

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